Louisiana Department of Wildlife and Fisheries

Office of Fisheries

2012 2012

OYSTER STOCK ASSESSMENT REPORT

OF THE

PUBLIC OYSTER AREAS IN LOUISIANA

SEED GROUNDS and SEED RESERVATIONS

Oyster Data Report Series
No. 18
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Cover Photo: Shoveling oysters to be taken to market. Courtesy of *The Louisiana Conservationist*.

Statewide Overview - 2012 Oyster Stock Assessment

Introduction

The oyster resource in Louisiana is one of the largest and most valuable in the nation. Its value is derived from both the economic benefits it provides to the state and the ecological benefits it provides to the estuarine environment. Due to Louisiana's vast coastal wetland area, ample habitat exists where oysters thrive under a variety of environmental conditions. The Department of Wildlife and Fisheries (LDWF) is charged with managing the oyster resource on the public grounds by closely monitoring the size and health of oysters on nearly 1.7 million acres of public water bottoms. Oyster management on these public grounds includes activities such as setting oyster seasons, monitoring harvest levels, and cultch planting (reef building) projects.

Typically, the oyster industry utilizes the public oyster grounds as a source of seed oysters (< 3") for transplant to private leases. The public grounds also yield a supply of sack-sized oysters (≥ 3") and these oysters may be taken directly to market. The manner in which both the public grounds and private leases are utilized in combination helps to keep Louisiana's industry as a national leader in oyster production with annual value typically in excess of $35 million worth of dockside sales.

Oysters also play an important ecological role in the estuarine ecosystem. Oyster reefs provide the majority of hard substrate required by other sessile invertebrate species such as barnacles, bryozoans, tunicates, and anemones. Reefs are also utilized as shelter and forage habitat for many species of crabs, worms, fish, and meiofauna. Estuarine water quality can be affected by the filter-feeding activities of oysters, and reefs may also play a role in stabilizing shorelines.

Louisiana Oyster Landings

Oysters have been a part of the Louisiana economy for many years and support a multi-million dollar industry. Louisiana regularly leads the nation in the production of oysters and accounted for an average of 34% of the nation's oyster landings over the 1997 – 2010 time period (Figure 1). However, in 2010, Louisiana landings of oysters (*Crassostrea virginica)* slid to one of its lowest points on record at approximately 6.8 million pounds. The 2010 harvest marked only the third time since 1950 that Louisiana has landed less than 7 million pounds and the lowest annual landing since 1966. Among Gulf of Mexico states, Louisiana consistently ranks #1 in landings and accounted for over 43% of all oysters landed in the region in 2010.

The public oyster grounds can be considered the backbone of the Louisiana oyster resource. These grounds are a valuable contributor to overall Louisiana oyster landings each year, while also supplying seed oysters transplanted to private leases for grow-out purposes. The trend from 1970 – 1992 showed the majority of Louisiana oyster landings came from private reefs. From 1992 to 2001, however, the public ground stock size increased, in general, and landings from the public grounds increased as well. In 2008, harvest levels significantly increased on the public grounds over 2007 levels and the public grounds produced approximately 47% of all oyster landings for the calendar year. This reliance on the public grounds reversed during the 2009-2011 time period and harvest data showed that 81% of all oysters landed in Louisiana came from private leases in 2011 (Figure 2).

When comparing the price per pound of oyster meat on public grounds and private leases, public ground oysters oftentimes command higher prices than oysters harvested from private leases. In 2011, public ground oysters fetched $3.99 per pound at the dock while private lease oysters valued over $0.30 less at $3.68 per pound. Overall average price per pound for all Louisiana oysters in 2011 ($3.74) rose for the third consecutive year compared to 2008 ($3.03), 2009 ($3.34) and 2010 ($3.59) according to preliminary LDWF Trip-Ticket data. This increase in the value of oysters at the dockside may be related to a continued lack of oyster supply. Nationwide 2011 landings data from the National Marine Fisheries Service (NMFS) were not available during the time period covered by this report. Therefore, preliminary 2011 Louisiana oyster landings data cannot be compared to national landings.

Statewide Oyster Stock Assessment Overview

Methods

Each summer, LDWF biologists from each Coastal Study Area (CSA) of the Fisheries Division perform quantitative evaluation of the oyster resource on the public oyster areas (Figure 3). This biological evaluation includes using SCUBA to collect oyster samples from within a square meter frame from multiple locations (sample stations) in each public oyster ground. At each station, five replicate square-meter samples are collected and data is combined to produce average numbers of spat, seed, and sack oysters per station. Spat are young oysters measuring one to 24 millimeters (mm) in length. Seed oysters measure 25 to 74 mm and sack (= market-size) measure 75 mm and above. The numbers of oysters per station is then multiplied by the reef acreage to obtain an estimate of the total oysters present on the reefs. Sampling undertaken as part of the annual stock assessment plays a valuable role in predicting the success of the upcoming oyster season, which generally opens in early September and runs through April of the following year (although the season may be closed or delayed if biological concerns or enforcement problems are encountered). This stock size information is used to make recommendations to the Wildlife and Fisheries Commission for the setting of the oyster season.

A total of 99 sample stations were visited by LDWF biologists during the 2012 assessment and 495 individual samples were gathered. Information gathered from sampling is divided into the respective CSAs and data are presented by CSA. Coastal Study Area 1 South holds the most sample stations (30) while CSA 5 East holds the fewest (3). A higher density of sampling occurs in the Black Bay (CSA 1 South) and Sister Lake (CSA 5 West) areas due to their high level of oyster production in past years and increased historical importance to the oyster industry.

Annual Stock Size

The statewide oyster stock size in 2012 has shown a precipitous decline from 2011 levels as approximately 1,234,327 barrels of oysters (± 370,270) are available on the public oyster areas of Louisiana this year (Table 1). Although this stock size represent an approximate decrease of 23.0% from 2011 levels, statistical comparisons of the two estimates show no significant statistical difference. The 2012 statewide stock availability is once again largely influenced by oyster stocks in Calcasieu and Sabine Lakes (CSA 7), but still remains approximately 63% below the long-term mean of 3.5 million barrels (Figure 4). Statewide seed oyster availability

dropped approximately 11% as compared to 2011 levels, while market-size availability decreased approximately 29% (Figure 5). Data generated from the 2012 oyster stock assessment sampling yielded continued troubling results both on a statewide level and within several CSAs.

Table 1. Estimated Statewide oyster stock size on the public oyster areas of Louisiana. CSA denotes Coastal Study Area. Percentage columns (%) indicate percent of statewide total. Data in barrels and 1 barrel = 2 sacks.

CSA	Seed	Seed %	Sack	Sack %	Total	Total %
1 North	118,758	23.6%	82,330	11.3%	201,088	16.3%
1 South	5,194	1.0%	27,102	3.7%	32,296	2.6%
3	10,513	2.1%	11,046	1.5%	21,559	1.7%
5 East	3,811	0.8%	1,149	0.2%	4,960	0.4%
5 West	46,609	9.3%	45,659	6.2%	92,268	7.5%
7	318,589	63.3%	563,567	77.1%	882,156	71.5%
Total	***503,474***		***730,853***		***1,234,327***	

The historic primary public grounds east of the Mississippi River in CSA 1 South showed continued decreases in oyster stock abundance falling approximately 62% to its lowest point since 1991. Positive signs were noted, however, in CSA 1 North where an approximate 231% increase in oyster stocks was estimated from biological sampling. CSA 3 sampling yielded mixed results with a substantial increase in market-size oyster stocks (+274%) but a decrease in seed-oyster availability (-43%). Results from square-meter sampling in Sister Lake (CSA 5 West) indicated a troubling drop in oyster availability as stocks decreased from over 200,000 barrels of oysters in 2011 to just under 84,000 barrels this year. Similar results were documented in CSA 7 as both Calcasieu and Sabine Lake saw decreases in market-size oysters during 2012 sampling. Despite the drop in CSA 7 oyster availability, that area continues to contribute the most animals towards the annual stock assessment (Table 1; Figure 6).

Factors Affecting the 2012 Oyster Stock Assessment

A variety of factors, both natural and anthropogenic, affect the oyster stock size on the public grounds in any given year. Natural threats to oyster survival include extreme low salinities caused by high river discharge and localized rainfall, as well as predation and disease typically associated with periods of high salinity and high temperature. Construction activities (e.g. oil and gas production), harvest and environmental perturbations (e.g. hurricanes) can also impact oyster abundance.

A significant event which continues to have impacts on a large portion of the coastline and oyster resources was the *Deepwater Horizon* oil spill of 2010. Research is ongoing into the possible impacts of oil, dispersant, and freshwater releases to Louisiana's near shore environment, including to oysters and oyster habitat.

Environmental Conditions

Scientific research indicates that reproduction of oysters becomes limited as salinities drop below seven parts per thousand (ppt). Additionally, salinities below five ppt coupled with water temperatures above 23^{o} Celsius has been documented to cause significant oyster mortalities. As depressed salinities continue into the hotter summertime months, physiological stress on oysters increases and mortalities can occur. This is a somewhat regular occurrence in areas such as the

Vermilion Bay system (CSA 6), but can also occur periodically in other areas of Louisiana's public oyster grounds.

Low salinity conditions occurred again in parts of the Louisiana coastline during critical reproductive time periods in the spring of 2012. Coastal Study Areas 1 North, 1 South, and 6 each experienced low salinities (< 7 parts per thousand) over large expanses of oyster habitat.

Oyster Reproduction and Larval Recruitment

The ability of a species to produce successful offspring is critical to long-term sustainability of the population. Oysters are broadcast spawners, and release millions of gametes (eggs and sperm) into the water column when environmental conditions are conducive to reproduction. This reproductive activity typically peaks in coastal Louisiana, cued mainly by water temperature changes, in the spring and fall of each year.

LDWF biological sampling since the spring of 2010 continues to show troubling indications of reproductive failures in some areas. Successful spat sets (the settlement of oyster larvae onto a suitable surface and the metamorphosis of those larvae into baby oysters, called spat) have been noted in some areas, while CSA 1 South has not had a widespread successful spat set event in over two years. This area experienced very little spatfall in the spring and fall of both 2010 and 2011, and spat were found at only three sample sites in CSA 1 South during the 2012 stock assessment. This poor larval recruitment success over the recent years may be due to the effects of the *Deepwater Horizon* oil spill and response efforts.

Reproductive success again varied widely among the CSAs, as evidenced by spat-to-oyster ratios (Figure 7) from the 2012 oyster stock assessment sampling. Strong reproductive output was achieved in CSAs 1, 3, 5E, and 6 as greater than one spat was produced per oyster. This data is highly dependent upon the number of animals collected in each size category, however, and should be evaluated alongside additional available data. For example, CSA 1 South sampling showed the highest spat-to-oyster ratio (Figure 7), yet overall catch-per-unit-effort (CPUE) of spat was only 1.4 spat per sample (the 2nd lowest among all CSAs). This seemingly contradictory data is the result of only 43 oysters (seed and market-size combined) being collected in the 155 samples taken in this area. Decreased reproductive success was noted in Sister Lake, Calcasieu Lake, and Sabine Lake where less than one spat per oyster was found.

Table 2. Harvest estimates for the 2011/2012 oyster season on the public oyster grounds of Louisiana. Data derived from fisheries dependent surveys of harvesting vessels (=boarding reports) and not from LDWF Trip-Ticket data (except CSA 7). 1 barrel = 2 sacks.

CSA	Seed Oysters (barrels)	Market Oysters (sacks)	Total (barrels)
1 North	16,810	16,876	25,248
1 South	19,350	91,342	65,021
3	1,659	29	1,674
5 East	827	2,809	2,232
5 West	15,765	86,912	59,271
6	0	2,638	1,319
7	0	27,930	13,965
Total	***54,411***	***228,436***	***168,729***

Commercial Harvest

Estimated commercial harvest rebounded during the 2011/2012 oyster season (Table 2) as compared to the previous season when extended harvest closures occurred for much of the season in response to the 2010 *Deepwater Horizon* oil spill. The 2011/2012 oyster season saw significant increases in harvest in each area, except for Calcasieu Lake. Harvest in CSA 1 South increased from zero barrels harvested during the 2010/2011 season to over 65,000 in 2011/2012. Likewise, strong harvest levels in Sister Lake drove a significant increase in oysters landed from the western portion of CSA 5. A complete closure of the east side of Calcasieu Lake impacted total harvest from CSA 7 dropping from roughly 83,000 sacks in 2010/2011 to approximately 28,000 sacks during this past season (Table 2).

Special Oyster Management Projects

Over the past year, LDWF biologists have participated in several important projects aimed at increasing oyster production on the public oyster seed grounds and reservations. Cultch planting is a reef rehabilitation method employed by LDWF since 1917 and was undertaken four times since last year's stock assessment. Additionally, LDWF partnered with the Louisiana Sea Grant oyster hatchery on Grand Isle to provide hatchery-raised oyster larvae and spat to specific areas on the public grounds.

Cultch Planting

In direct response to oyster impacts from the Deepwater Horizon oil spill, two emergency restoration cultch plants were constructed in the fall of 2011 funded from existing state monies. Approximately 31,500 cubic yards of crushed concrete cultch material was spread over a 300-acre location in Mississippi Sound (St. Bernard Parish) just south of Halfmoon Island in September 2011. In October 2011, approximately 28,000 cubic yards of oyster shell and limestone cultch material was spread over 300 acres in California Bay (Plaquemines Parish) just west of Pelican Island (Table 4). Biological sampling of these two cultch plants during the 2012 oyster stock assessment yielded troubling results as only a few spat were documented on the Mississippi Sound location and no spat were collected on the California Bay site.

As part of early restoration to address injuries to natural resources caused by the Deepwater Horizon oil spill, cultch material will be placed onto approximately 850 acres of public oyster seed grounds throughout coastal Louisiana at six cultch planting locations. The first two early restoration cultch plants were completed in May 2012. For these two cultch plants, limestone material was placed at the northwest portion of the public oyster seed grounds in Hackberry Bay (Lafourche Parish) and at Sister Lake (Terrebonne Parish) (Table 4). Biological sampling during the 2012 oyster stock assessment on both of these cultch plants showed indication of reef development. Hackberry Bay samples held an average of over 108 spat per square-meter and an average of 27.2 spat per square meter were collected in Sister Lake samples. Updates and monitoring information regarding the Deepwater Horizon Natural Resource Damage Assessment and early restoration projects will be posted at www.losco-dwh.com.

Hatchery-Raised Larvae and Spat

Oyster larvae and spat raised at the Louisiana Sea Grant bivalve hatchery on Grand Isle were supplied to various public oyster areas in the late summer of 2011 and early summer of 2012.

While the goal of the initial spat/larval deployments was to test and refine various deployment methods, it is hoped that the deployments will augment natural oyster stocks. In August 2011 (one month after the 2011 stock assessment sampling occurred), approximately 40 million hatchery-produced oyster larvae were released in the Hackberry Bay Public Oyster Seed Reservation. In June 2012, approximately 2.7 million hatchery raised oyster spat were deployed at the 2011 cultch plant locations in Mississippi Sound and California Bay. Continued deployments of spat at these locations, as well as deployments of larvae in Calcasieu Lake, are planned for summer and fall of 2012.

Recent Legislation

The 2012 regular legislative session included four notable bills filed with direct ties to oysters (Table 3). Two bills could directly impact oyster harvest on this years' oyster stock – HB 431 and SB 202. House Bill 431 was passed as Act 85 and reopened the application period for new Public Oyster Seed Ground Vessel Permits. Vessel owners who wish to obtain a permit will be able to apply for a new permit beginning August 1, 2012, although original qualification criteria still apply. Senate Bill 202 was passed as Act 541 and removed qualification requirements and limits on the number of permits that could be issued for the Calcasieu Lake Oyster Harvester Permit. Both acts could result in increases in the number of vessels fishing the public oyster areas in the coming season.

Table 3. Summary of oyster-related legislation of the 2012 Louisiana regular legislative session.

Bill	Author(s)	Description	Passed?	Act
HB406	Greene	Authorizes the LWFC to establish recreational reefs where oyster harvest is prohibited	Yes	**84**
HB431	Garofalo	Reopens the application period for Public Oyster Seed Ground Vessel Permits from August 1, 2012 – December 31, 2012	Yes	**85**
HB683 / HB1190	Dove	Authorizes LDWF to issue permits for alternative oyster culture (AOC) activities, such as off-bottom oyster culture, within the boundaries of an existing oyster lease	Yes	**293**
SB202	Morrish	Removes the qualification requirements and limit on number of Calcasieu Lake Oyster Harvest Permits that can be issued by LDWF for commercial oyster harvest	Yes	**541**

Conclusion and Acknowledgements

The following report includes both biological stock assessment and historical oyster landings data from each CSA in Louisiana, as well as a brief report on the most recent oyster season in each area. Biological data was generated from quantitative square-meter sampling (see above) and landings data was generated from field boarding runs and trip ticket information. Countless hours were spent by the field biologists of each CSA, both in gathering the samples and producing the report. Additionally, Harry Blanchet, Ty Lindsey, Felixcia Blanchard, and Denise Kinsey greatly assisted with editorial review and preparation of this document. The efforts of both the field and office staff are greatly appreciated as this report could not be produced without the hard work and dedication of these many people. Questions and/or comments can be directed to Patrick Banks at 225.765.2370 or pbanks@wlf.louisiana.gov.

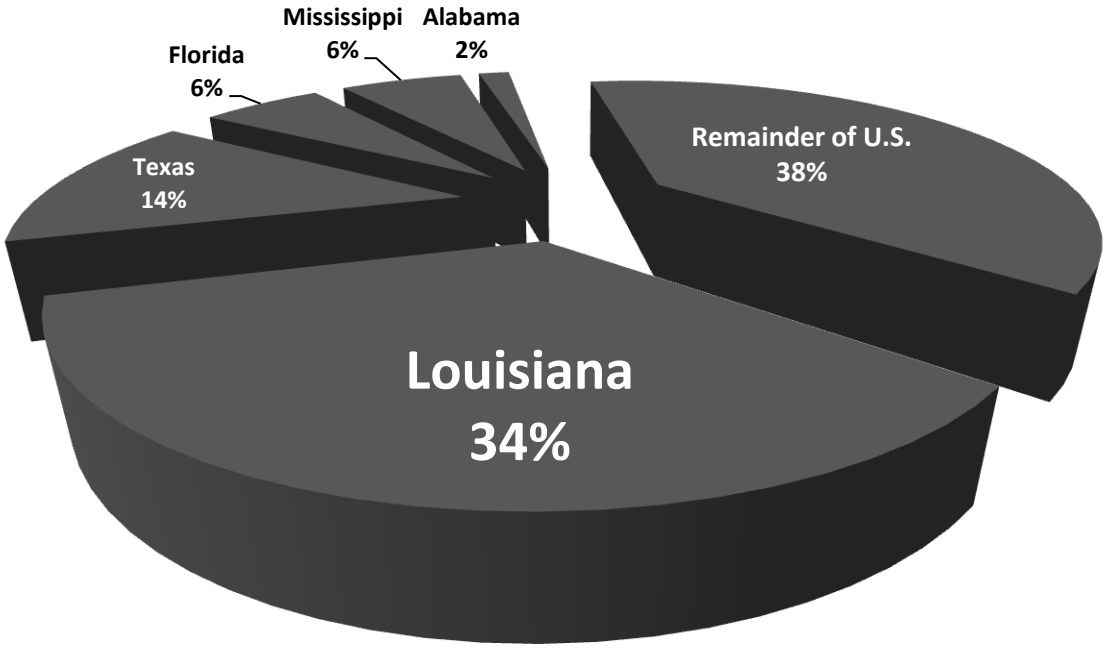
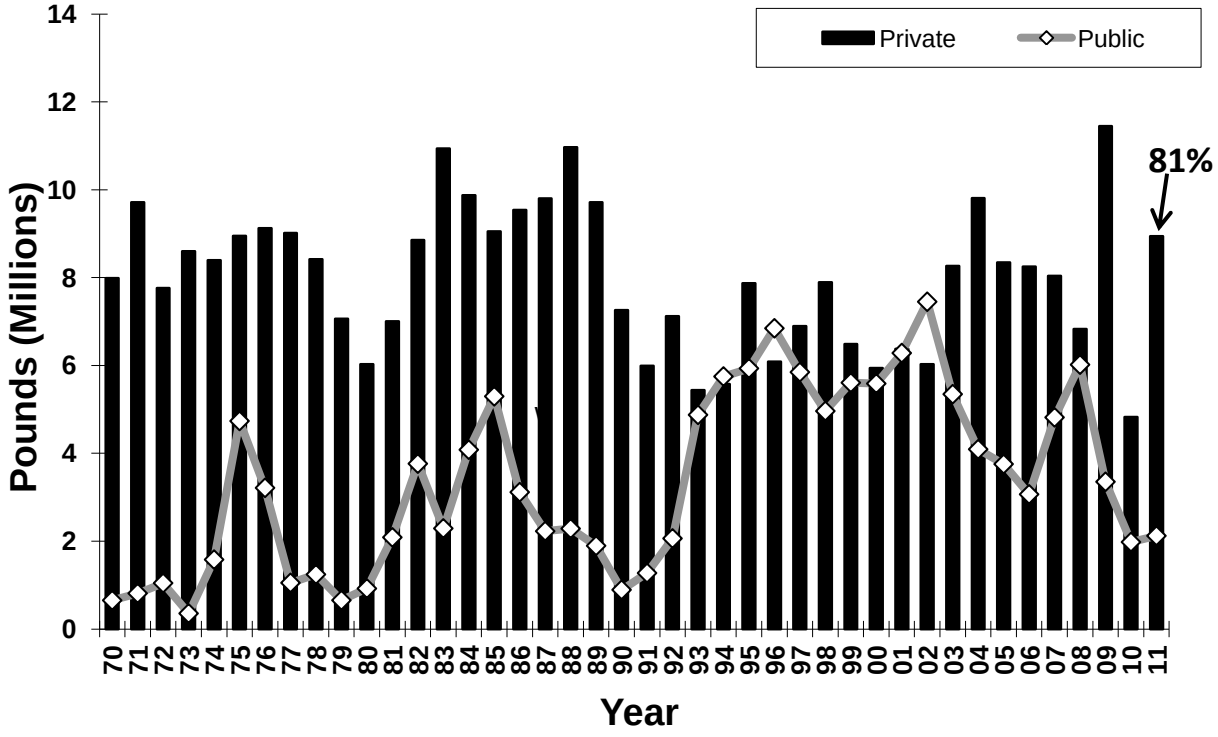


Figure 1. Percentage contribution to average annual landings of all oysters in the United States over the time period of 1997 through 2010. Data provided by National Marine Fisheries Service (NMFS).



Note: Long-term average (1961 to 2010) for private landings is 8.012million pounds. LTA for public landings is 3.049

Figure 2. Historical Louisiana oyster landings for the public oyster areas and the private oyster leases (LDWF and NMFS data). 2011 harvest from private leases accounted for approximately 81% of the total.

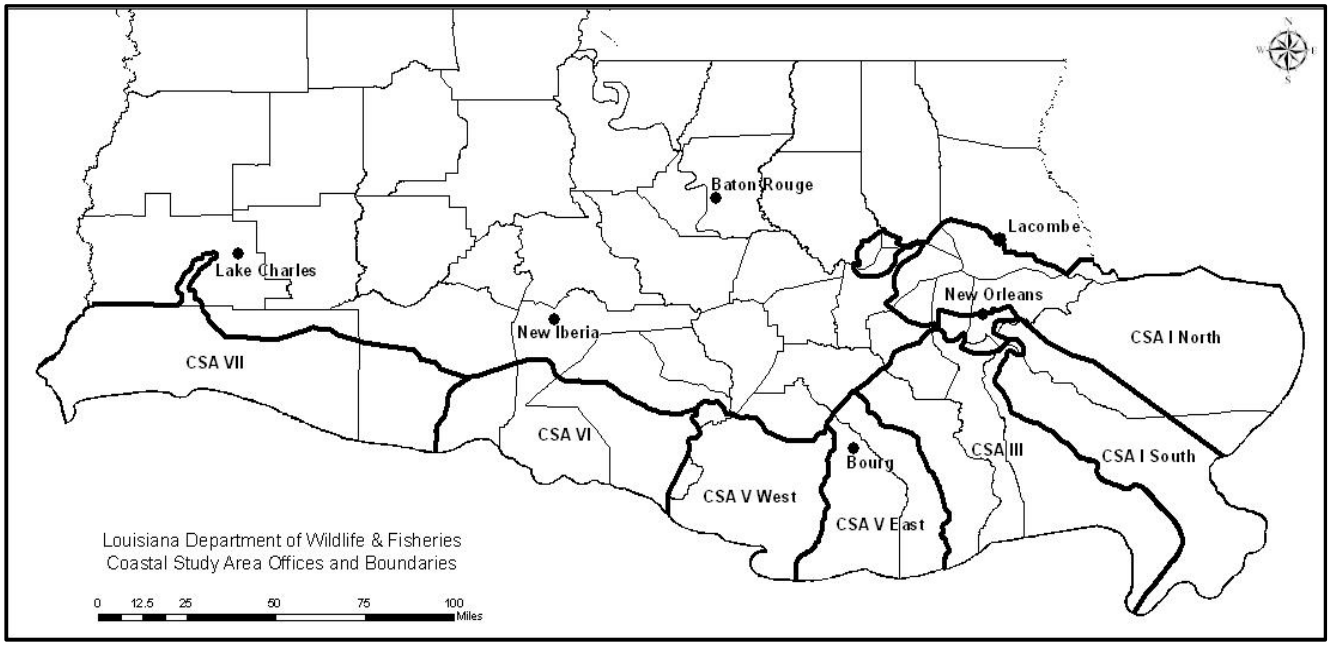


Figure 3. Map of LDWF Fisheries Division Coastal Study Areas (CSAs).

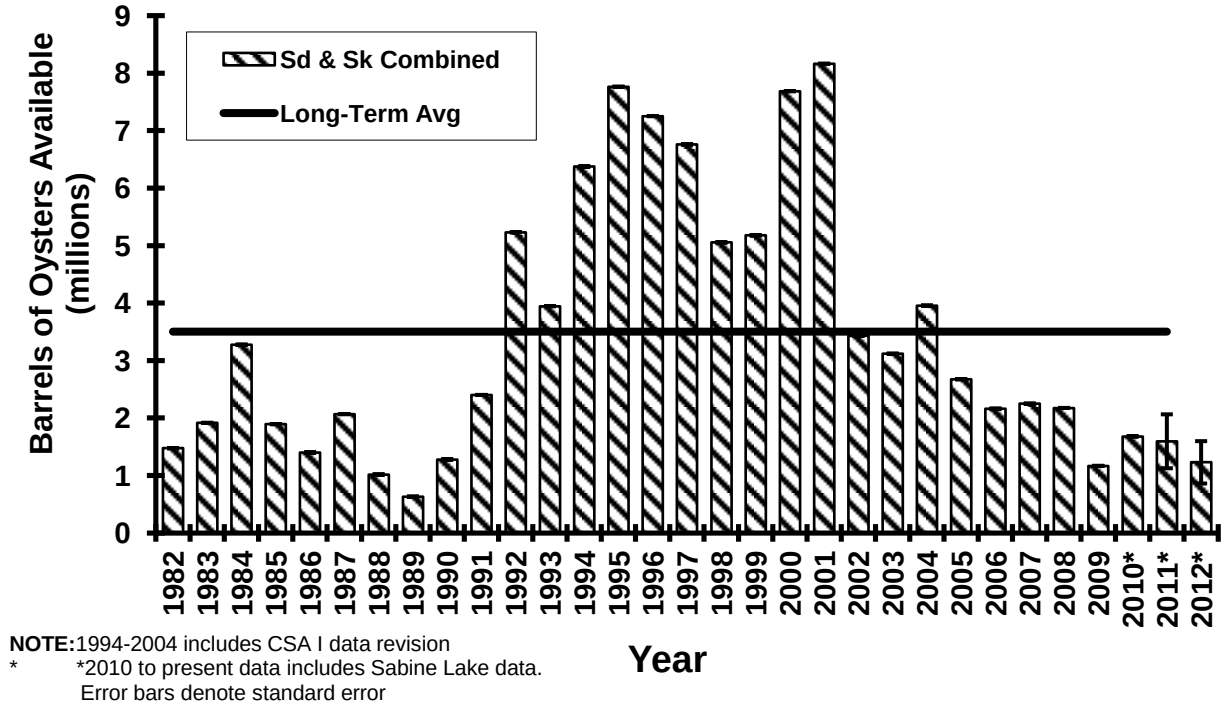
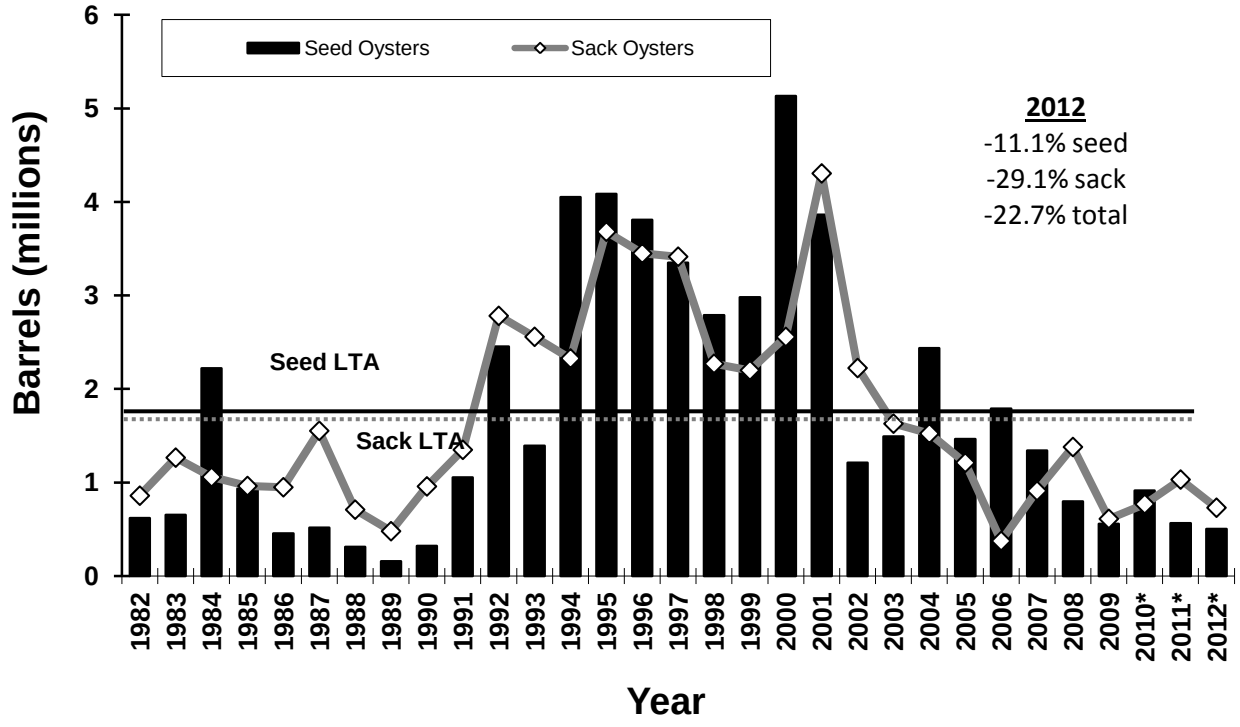


Figure 4. Historical estimated oyster stock size (Sd = seed oysters; Sk = sack or market-size oysters) on the public oyster areas of Louisiana. 1994 through 2004 data includes CSA 1N data revision. LTA denotes the long-term average of 1982 - 2011.



NOTE:1994-2004 includes CSA I data revision
* 2010 to present data includes Sabine Lake

Figure 5. Historical Louisiana oyster stock size on the public oyster areas. LTA denotes the long-term average of 1982 - 2011.

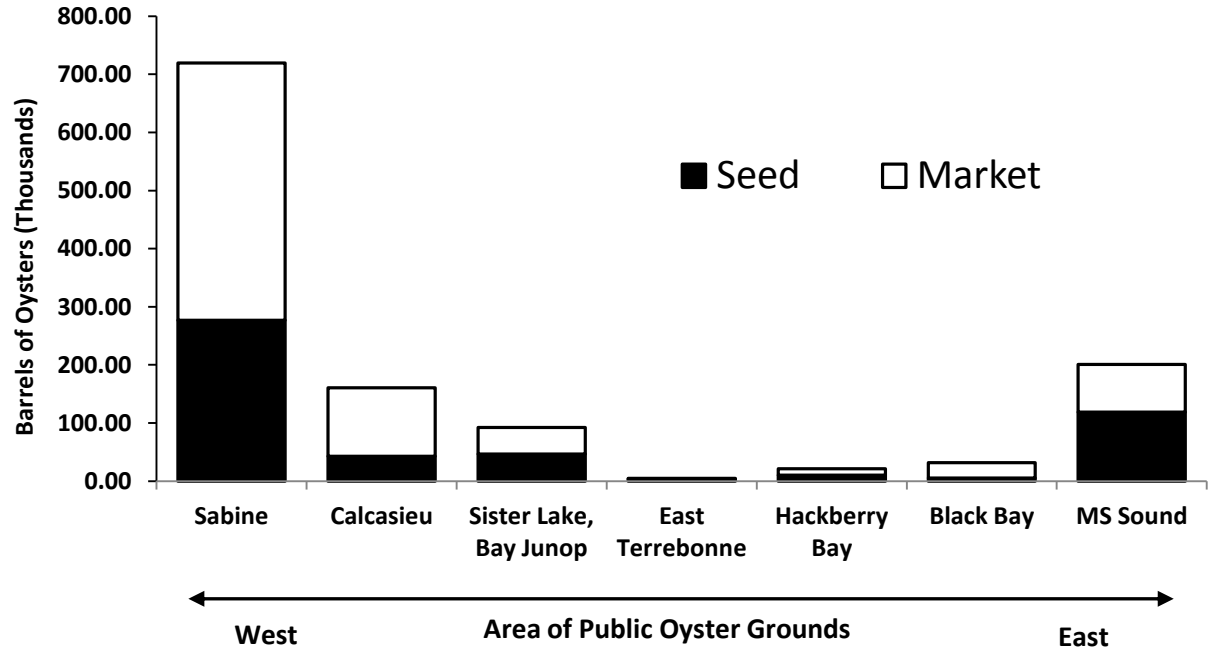


Figure 6. Statewide distribution of oyster stocks in the public oyster areas of Louisiana.

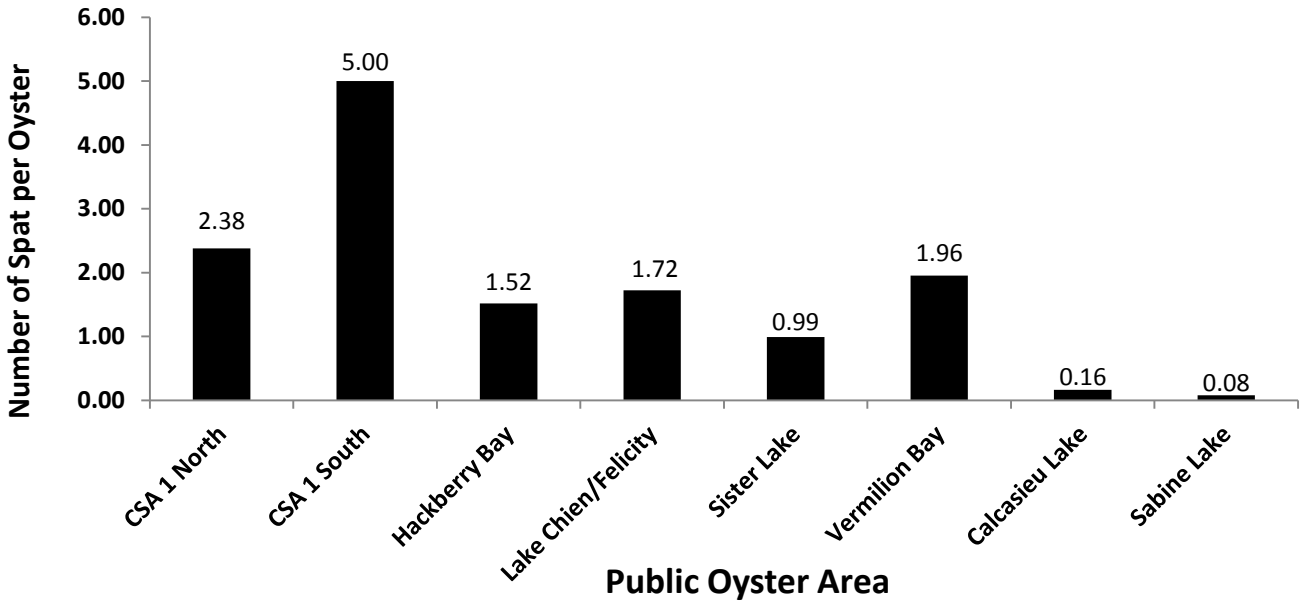
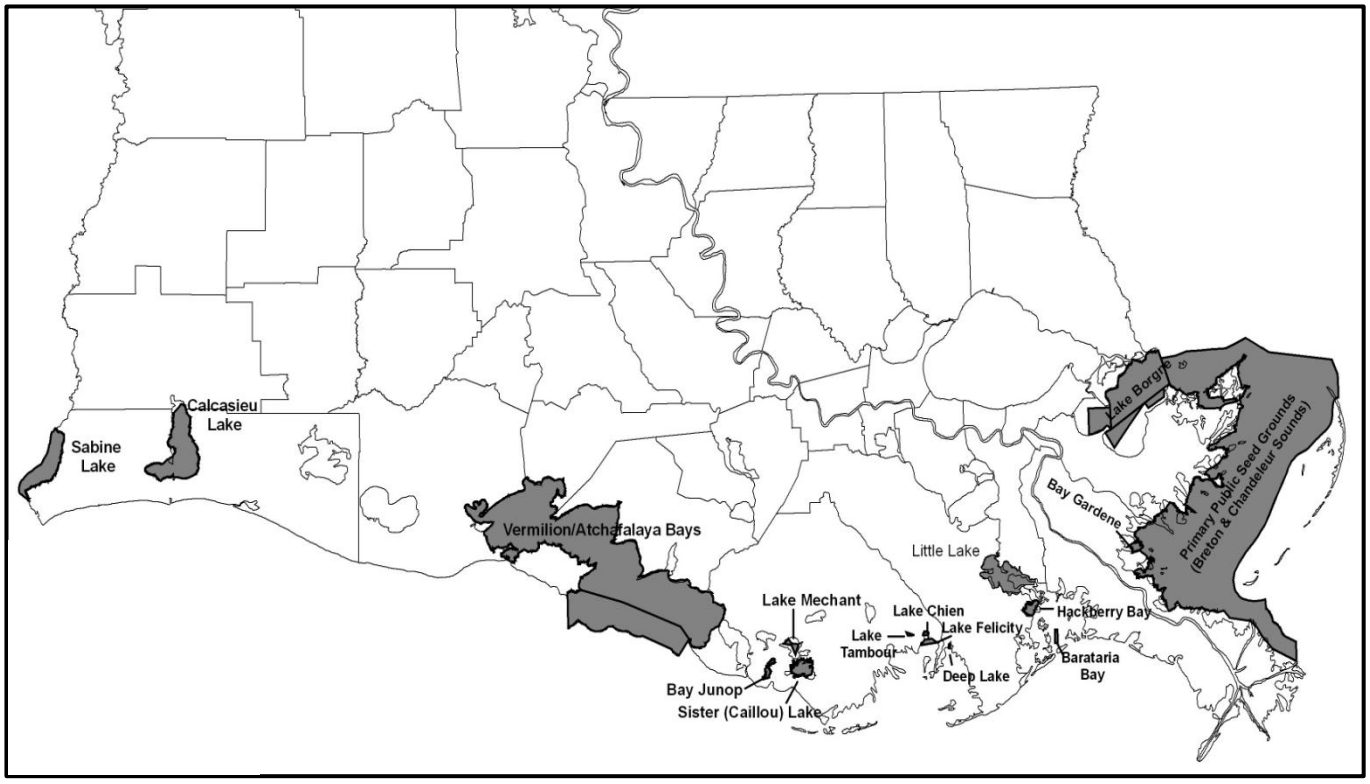


Figure 7. Spat-to-oyster ratios from 2012 oyster stock assessment sampling in various portions of the public oyster areas of Louisiana. "Oyster" indicates a combination of seed and market-size oysters.

Table 4. Recent cultch planting projects performed in public oyster areas

Year	Location	Cultch Type	Volume (yd^3)	Acreage	Yards Per Acre	Total Cost	Cost/yd^3	Cost/Acre
2011	Mississippi Sound	crushed concrete	31,308	291	107.6	$1,476,160.88	$47.15	$5,072.72
2011	California Bay	shell/limestone	27,988	302	92.7	$1,665,006.12	$59.49	$5,513.27
2012	Hackberry Bay	limestone	26,086	200	130.4	$1,485,084.91	$56.93	$7,425.42
2012	Sister Lake	limestone	37,681	358	105.3	$2,166,688.95	$57.50	$6,052.20

Public Oyster Areas



Public Seed Grounds*

- Lake Borgne
- Chandeleur/Breton Sound
  (Primary Public Oyster Seed Grounds)
- Barataria Bay
- Little Lake
- Deep Lake
- Lake Chien
- Lake Felicity
- Lake Tambour
- Lake Mechant
- Vermilion/Cote Blanche/Atchafalaya Bays

Public Seed Reservations**

- Bay Gardene
- Hackberry Bay
- Sister (Caillou) Lake
- Bay Junop

Public Oyster Areas**

- Calcasieu Lake
- Sabine Lake

*Seed grounds are designated by the Louisiana Department of Wildlife and Fisheries Commission
**Seed reservations, Calcasieu Lake, and Sabine Lake are designated by the state legislature

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North Pontchartrain Basin (CSA1N) – 2012 Oyster Stock Assessment

Introduction

The Public Oyster Seed Grounds in the North Pontchartrain Basin (formerly CSA1) consist of approximately 690,000 water bottom acres and are located within the Louisiana portion of Mississippi Sound, Lake Borgne, Chandeleur Sound and adjacent waters. These oyster areas are harvested by both Louisiana and Mississippi fisherman, and have historically been areas of high oyster production within the state of Louisiana. Although managed as public oyster seed grounds by the State for many decades before, the majority of this area was not designated as such by Louisiana Wildlife and Fisheries Commission rule until 1988. Much of Lake Borgne was later added as a public oyster seed ground in 1995 and was expanded in 2004. The Department also continually expands and enhances the public oyster reefs through the placement of cultch material (i.e. shell, limestone, crushed concrete) on suitable water bottoms. Most recently plants were completed in Mississippi Sound in 2007 and 2011; and in Three-Mile Bay in 2009.

Currently, these areas are managed to balance the economic opportunity of the fishery with the biological sustainability of the resource. This management is contingent upon obtaining and utilizing the best fishery dependent and independent data available. This includes monitoring the harvest and resource availability throughout the fishing season and performing yearly stock assessments. The information these data provide allow resource managers to implement management changes to both effectively utilize the current resource as well as protect long term viability. This report will fulfill one of those data needs by providing estimates of the current stock size of the oyster resource within this Basin.

Methods

Samples were taken between July 02 and July 09, 2012 using a one square-meter frame placed directly on the water bottom. Divers removed by hand all live and dead oysters within the frame, as well as any exposed substrate. Live and dead oysters, spat, fouling organisms, and oyster predators were identified and enumerated. A total of 16 stations were visited with five square-meter replicates taken at each station. The average of the replicates was then pooled within reef systems. This average density per reef system was multiplied by the total area of the reef systems. The resulting number was adjusted into a barrel unit of measure where one barrel equals 720 seed-sized oysters or 360 market-sized (sack) oysters. Seed oysters are those measuring between 25 and 74 mm with market oysters being greater than 74 mm. Spat oysters are those 24mm and less. The Lake Borgne Public Oyster Seed Ground was not sampled due to a lack of reef acreage information.

Results and Discussion

Seed and Sack Stock

The current stock size is estimated at 118,758 barrels (bbls) of seed-size oysters and 82,330 bbls of market-size oysters. These numbers include all of the currently assessed reefs and the 2009 Shell Point cultch plant (Figure 1.1). Comparing with last year's assessment, there was a 252% increase in the seed-size estimate and a 204% increase in the sack-size estimate, which were the lowest on record in 2011 (Figure 1.2).

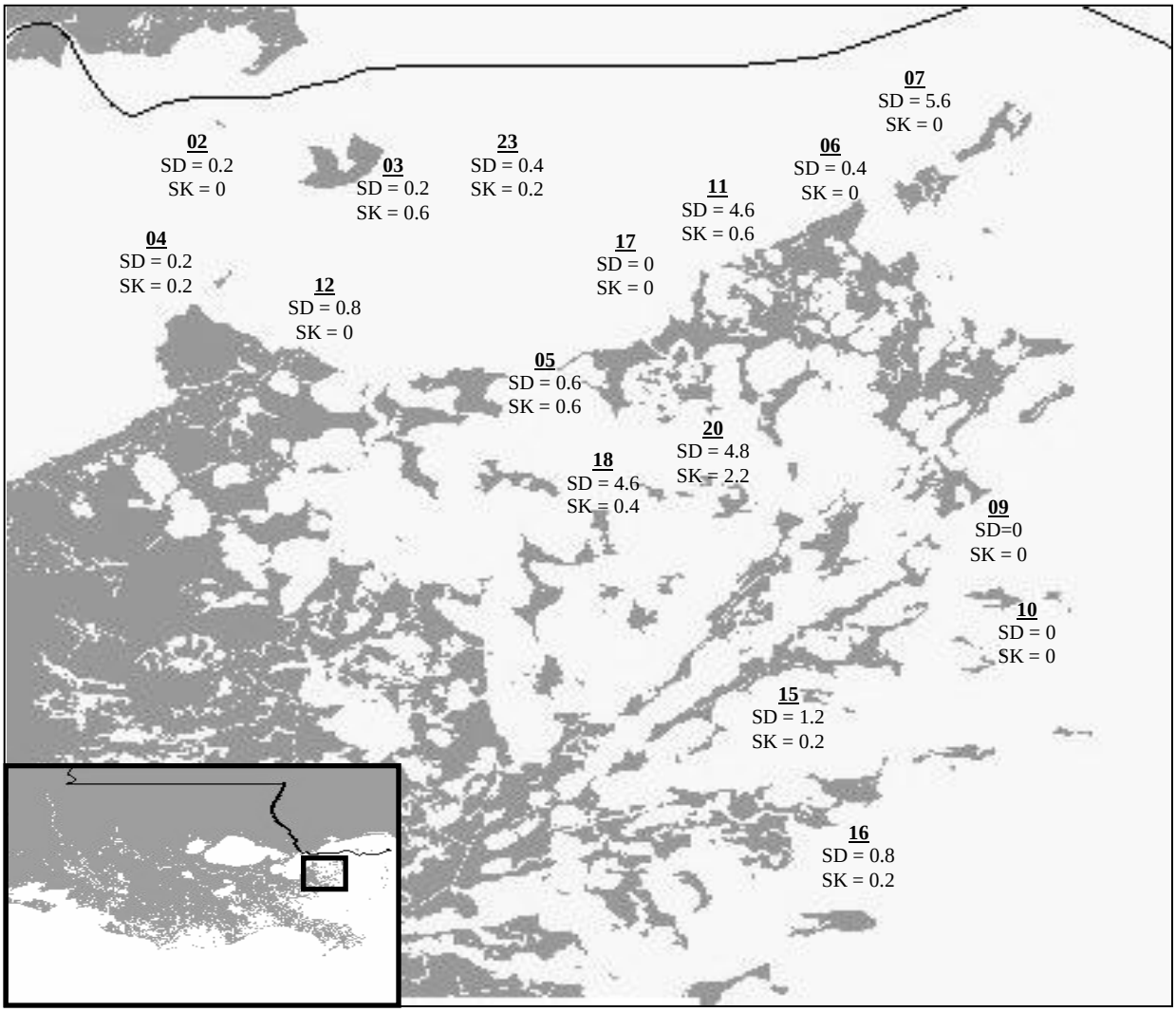

Figure 1.1. Map showing North Pontchartrain Basin oyster stock assessment stations. Numbers below stations are average numbers of seed (SD) and sack (SK) oysters per m^2.

Oyster density and abundance were not evenly distributed among areas (Table 1.1) with the highest density estimates of seed at Cabbage Reef and highest density estimates of sack oysters at the West Karako site. Highest overall abundances of seed and sack oysters were in the Three-Mile/West Karako areas. It is important to note variability both within and among stations when comparing estimates. This variability is magnified when extrapolating small sample sizes to large areas. In short, changes since last assessment have been dramatic on an individual reef basis and only limited areas of large resource availability were identified.

Table 1.1. Mean densities of oysters collected at each station. Values in parenthesis are percent changes from the 2011 assessment

Station	Station Number	Reef Group Acreage	Seed Oysters per m2	Sack Oysters per m2	Number of seed oysters (bbls)	Number of sack oysters (bbls)
Grassy Is.	2		0.2	0		
Halfmoon Is.	3	6,850	0.2	0.6	9,626 (0%)	19,251 (+500%)
Petit Is.	4		0.2	0.2		
Grand Banks	23		0.4	0.2		
Three-mile Bay	5	3,059	0.6	0.6	46,418 (+386%)	48,138 (+700%)
West Karako Bay	20		4.8	2.2		
Grand Pass	6		0.4	0		
Cabbage Rf.	7	1,802	5.6	0	35,783 (+2651%)	4,050 (+100%, 0 in 2011)
Turkey Bayou	11		4.6	0.6		
Martin Is.	9		0	0	0	0
Holmes Is.	10	4,156	0	0	(0%)	(0%)
Shell Point	18		4.6	0.4	1,220 (-83%)	212 (-88%)
Johnson Bayou	17	200	0	0	0 (-100%, 0 in 2012)	0 (-100%, 0 in 2012)
Millennium Reef	12	70	0.8	0	315 (+399)	0 (0%, 0 in 2011 and 2012)
Drum Bay	15	1,796	1.2	0.2	12,113 (+100%, 0 in 2011)	4,038 (+100%, 0 in 2011)
Morgan Harbor	16	2,954	0.8	0.2	13,283 (+100%, 0 in 2011)	6,641 (-50%)
Hospital Wall[1]	1	376				
2012 Total					**118,758 (+252%)**	**82,330 (+204%)**

[1] station temporarily suspended.

The current estimate falls well below the previous ten years' average for both seed and sack oysters (Figure 1.2). However, the long-term averages are largely driven by availability of seed oysters in 2004, and sack oysters in 2004 and 2008. There have been several years of heavy localized harvest, high recent mortalities, strong tropical events such as Hurricane Katrina in 2005, the *Deepwater Horizon* oil spill, related spill response activities, and continual limits to recruitment that appear to have severely limited abundances.

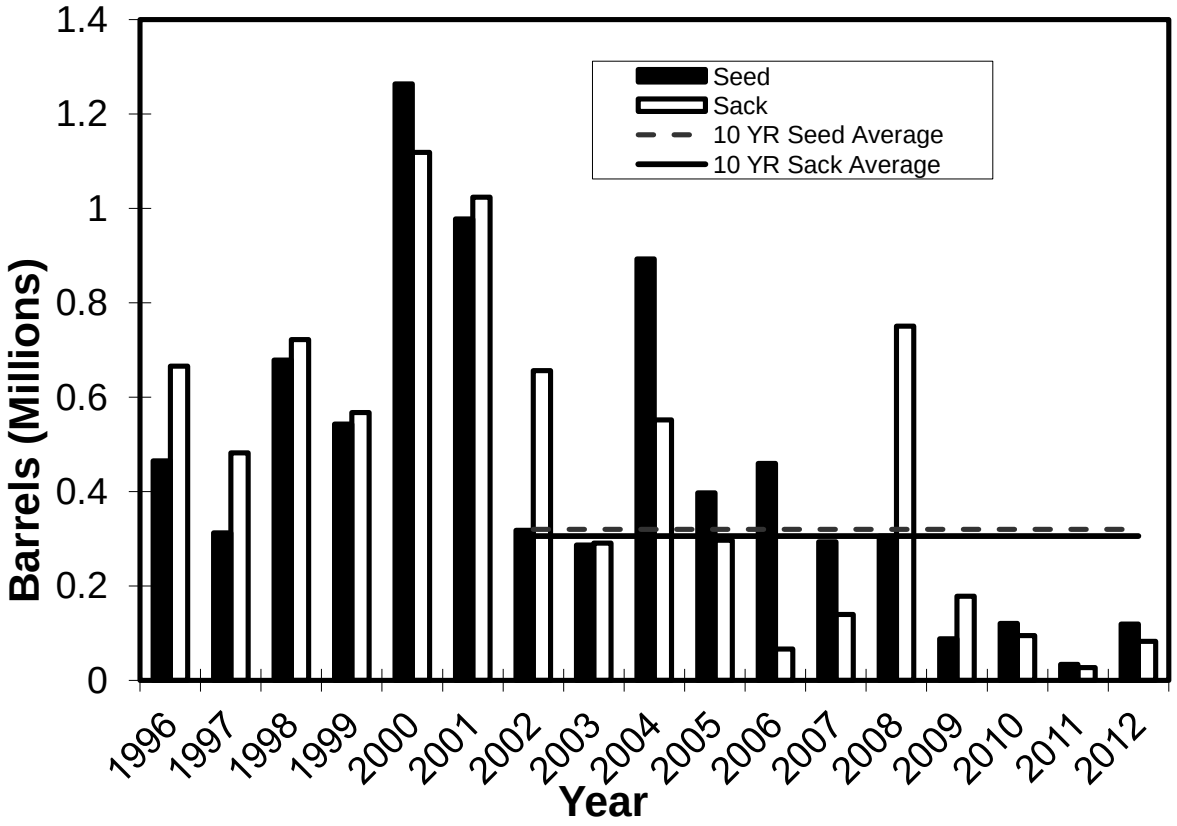

Figure 1.2. Current and historical Stock Assessment (seed and sack oysters) values. Horizontal lines represent the previous ten-years' seed and sack average.

Spat Production

Live spat were not present in all samples containing a suitable substrate. Means ranged from 0 to 19.2 individuals per m2 with the maximum value occurring at Grassy Island. While occurrence was up from last season, overall spat densities were low with the exceptions of Grassy Island and Cabbage Reef. Based on previous years' data, the square meter samples may have occurred between seasonal spawning events in some areas. It is important to note that spat numbers are biased by the amount of substrate collected in a given sample. However, this continues an observed lack of spat set over several of the reef areas during the spring spawning events. This could be attributed to several different things or a combination of stressors discussed below.

Fouling Organisms

The hooked mussel, *Ischadium recurvum*, a sessile bivalve that is often times associated with oyster reefs and competes with oysters for food and settlement surfaces were observed at 8 of the 16 sample stations. The highest density of mussels was 186.8/m2 at the Grassy Island sample station. (Table 1.2) Higher mussel densities were generally restricted to the lower salinity areas in Lake Borgne and western Mississippi Sound. Higher mussel densities were noted pre-stock assessment but increases in salinity seemed to have lowered the mussel densities on reefs in eastern Mississippi Sound. Additionally, Spionid polychaetes mud tubes, ctenostome and fairy lace bryozoans, the tube dwelling amphipod, Apocorophium, and other small hydroids have been indentified on live oysters and the exposed shell in the assessment area. This covering appears to have a limiting factor on the attachment of oyster larvae to the substrate.

Table 1.2. Mean density of the hooked mussel, *Ischadium recurvum*, and the southern oyster drill, *Stramonita haemastoma*, at each station.

	I. recurvum **density/(m^2)**	***S. haemastoma*** **density/(m^2)**
Grassy Island	186.8	0
Petit Island	8.6	0
Half-moon Island	68.6	0
Grand Banks	0.4	0
Three-mile Bay	24	0
West Karako Bay	0	0
Grand Pass	0	0
Turkey Bayou	31.6	0
Cabbage Reef	0	0
Johnson Bayou	0	0
Shell Point	20.6	0
Millennium Reef	20.2	0
Drum Bay	0	0
Morgan Harbor	0	0
Martin Island	0	0
Holmes Island	0	0

Oyster Predators

The southern oyster drill, *Stramonita haemastoma*, a predatory marine snail known to prey on oysters was not collected at any of the sample stations. Nor were any oyster drill egg casings found. No stone crabs, *Menippe adinia*, or blue crabs, *Callinectes* spp., were collected in the square meter samples. Other Xanthid crabs were noted in the samples that contained shell for substrate.

Dermo, *Perkinsus marinus*, a protozoan parasite that infects live oyster tissue, is known to cause extensive oyster mortalities especially under high salinity and water temperature conditions. Oyster tissue samples to be tested for presence of this parasite were collected at two sites in

North Pontchartrain Basin, Cabbage Reef and Three-Mile Bay. Results of the Dermo tests are presented in another section of this document.

Mortality

Recent mortality estimates show a decrease compared to last year, but are still highly variable between size classes and stations (Table 1.3) during this sampling event. Spat mortalities ranged from 0% to 100% with an average of 15.7% (36.7% in 2011) in the stations that had spat oysters. The highest spat mortalities were located in the Mississippi Sound and Drum Bay. Seed mortalities ranged from 0% to 100% with an average of 17% (24% in 2011) in the stations that had seed oysters. The highest seed mortalities were in Mississippi Sound. There was no sack mortality noted in the assessment sampling. It is also important to note that most of these mortality estimates are based on an extremely small number of animals. For many of these areas, assessment samples were taken after apparently large mortality events that have either subsided or have severely depleted abundances (see Cumulative Impacts and Mortalities section below).

Table 1.3. Mean oyster mortality (recent) estimates from each square-meter sample station N/A – no live or dead oysters were collected for mortality estimates.

Station	Spat Mortality (%)	Seed Mortality (%)	Sack Mortality (%)
Grassy Island	8.6	0	N/A
Millennium Reef	11.4	20	N/A
Johnson Bayou	100	100	N/A
Petit Island	N/A	0	0
Half Moon Island	30	66.7	0
Three-Mile Bay	0	25	0
Turkey Bayou	13	12.5	0
Cabbage Reef	1.2	0	N/A
Grand Pass	10	0	N/A
Shell Point	8.8	0	0
Drum Bay	22.2	0	0
Morgan Harbor	0	20	0
Martin Island	N/A	N/A	N/A
Holmes Island	N/A	N/A	N/A

Tropical and Climatic Events

There were no tropical systems affecting the northern Gulf of Mexico since the last stock assessment. The Pearl River system provides a relatively large volume of fresh water into the western Mississippi Sound in March. This event depressed the salinities on the reef systems in

the Mississippi Sound. The salinities at Grassy Island and Petit Island were less than 5 parts per thousand (ppt) for several weeks in April (Figure 1.3).

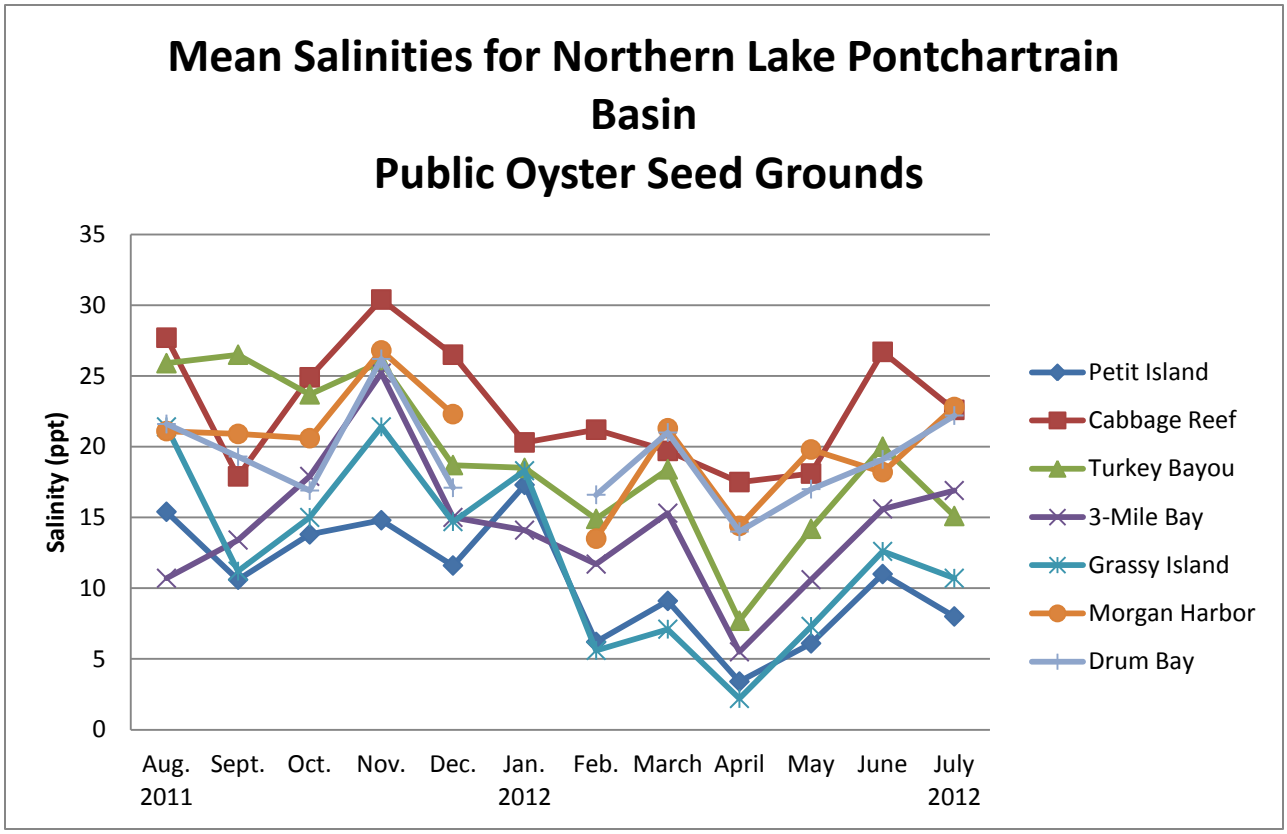

Figure 1.3. Salinities for the Northern Lake Pontchartrain Basin Public Oyster Seed Grounds since 2011 Assessment. Data presented are from discrete measurements on each reef.

2011/2012 Oyster Season Summary

Several tools are used by research personnel to estimate harvest and assess the biological condition of the resource.

Cumulative Impacts and Mortalities

This section will focus on greater detail concerning environmental conditions observed, as well as direct impacts that have occurred since the previous stock assessment in 2011 or continual impacts to the population. It is also important to note that many of the topics listed below are correlated with one another, i.e. freshwater inputs-salinity stratification-hypoxia.

Deepwater Horizon Oil Spill and Related Response Actions

The *Deepwater Horizon* oil spill released millions of barrels of oil into the Gulf of Mexico affecting the Louisiana coastline. In direct response to the spill, in an effort to keep incoming oil from the Gulf out of Louisiana's sensitive marshes and estuaries, freshwater was released from diversions and siphons along the Mississippi River. The impacts of oil and freshwater diversions

on oyster health and habitat continue to be of concern. Assessments on the direct and indirect impacts of oil and response actions on Louisiana's near shore environment, including oysters and oyster habitat, is ongoing.

Hypoxia

The definition of hypoxia varies as it is based on the percent saturation of water by oxygen. This varies with temperature and amount of other solutes. For most environmental assessments in this area, hypoxia can be viewed as concentrations of dissolved oxygen below 3 milligrams per liter (mg/L). As oysters are a sessile species, reef systems can often be impacted by hypoxia in an estuarine setting. Within the Pontchartrain Basin estuary, the most common driver of hypoxia over reef systems is the stratification of the water column due to density differences in water masses. These density differences are oftentimes driven by salinity and temperature. Basically, warmer, fresher water overrides denser salt water and does not allow the diffusion of oxygen throughout the water column. This is common in areas that have experienced high fresh water inputs, especially after the return of higher salinity waters once fresh water inputs subside. In other cases, in relatively confined areas, increases in biological oxygen demand can also lead to hypoxia, although localized. Some instances of hypoxia are "usual" in most areas, but prolonged exposure can result in reduced growth, decreased disease resistance, or direct mortality.

At the time of the 2012 assessment, there was no hypoxia detected on North Pontchartrain Basin reef systems. However, prior to the 2011 stock assessment, hypoxic conditions were noted. This condition was brought about by interaction of freshwater inputs and the higher salinity waters of Chandeleur Sound. Lowered dissolved oxygen concentrations and hypoxia became widespread throughout the assessment area starting in June 2011 and had become persistent in some areas.

Freshets

The Pearl River system had a higher than normal discharge rate in March and April 2012. The POSG in western Mississippi Sound are impacted by this higher discharge rate. This is evidenced by salinities being recorded as low as 2.0ppt at Grassy Island and 3.4ppt at Petit Island. Although these values are discreet measurements, these values were also seen in non-related observations as well as data derived from continuous environmental data recorders within the area.

While freshets often provide benefits to the reef system, either by reducing disease or predation, or by enhancing cultch opportunities, there are often other cumulative impacts that may affect recovery from any one event. The impact/recovery are also modified by not only the magnitude of a freshet, but perhaps also by the duration and timing.

Sedimentation/Subsidence

During periods of high freshwater input, sedimentation over reefs can be a problem. This sedimentation can affect the reef either through direct mortality (burial) or through reduced growth and reproduction (both production and clean places for larval attachment). During the 2012 assessment, divers noted on many reefs, especially in the Mississippi Sound area, that some of the cultch had a covering of silt and still other areas were buried. Both of these conditions limit the amount of suitable substrate available for larval settlement.

Subsidence of the reefs is usually balanced by reef accretion or growth. If no appreciable shell is added over a period of time, the reefs, especially those in less than optimal environments, will subside to the point of shell burial. The lowering of the reef profile also subjects associated organisms to more frequent hypoxia events as well as changing the local water flow and sedimentation process.

Cultch Condition

Any successful spat set is dependent upon clean, stable cultch for larval attachment. The condition of the cultch and live oyster shell within the North Pontchartrain Basin currently appears to be poor. As noted above, many areas are buried or covered with a thin layer of silt. On some reefs in the Mississippi Sound area, the cultch is covered by Spionid polychaetes mud tubes, ctenostome and fairy lace bryozoans, the tube dwelling amphipod, *Apocorophium*, and other small hydroids. In other areas, the addition of shell to a reef has become so infrequent that the cultch on hand is being transformed into small "hash" particles that may not provide optimal substrate for larval attachment.

Harvest

Harvest estimates are obtained by monitoring the users and by obtaining fishery dependent data. Fishermen are contacted while fishing and asked to provide estimates of current and past catch and effort as well as an estimate of future effort. This data is obtained weekly during the oyster season and is used to estimate harvest in a particular reef complex. Harvest data is also obtained via the trip ticket system in place for this fishery. However, this data is consolidated by geographic region and is considered preliminary until well after the season concludes, and provide a limited resolution.

Table 1.4 Harvest estimates from the 2011/2012 public season within North Pontchartrain Basin

Station	Seed-size (bbls)	Market-size (sacks)
Grassy Island	0	0
Half-moon Island	0	0
Petit Island	0	2,712
Lake Borgne	0	1,012
Millennium Reef	0	0
Grand Banks	0	0
Three-Mile Bay	0	5,165
Turkey Bayou	0	0
Johnson Bayou	6,600	54
Grand Pass	6,700	2,274
Cabbage Reef	0	0
West Karako	460	5,270
Drum Bay	0	32
Morgan Harbor	0	30
Bay Eloi	0	0
Shell Point	3,050	287
Total	**16,810**	**16,876**

Fishery independent methods are used to obtain the health and condition of the resource both prior to and during the final stages of the fishing season. Techniques used in these assessments are oyster dredging and visual census. It is important to note that both fishery dependent and independent sources are subject to several large biases and should be used in conjunction to provide a better estimate of the available resource.

The season within the North Pontchartrain Basin oyster seed grounds opened on October 31, 2011 and closed on February 2, 2012. During this time period, the total harvest estimates for the

grounds were 16,810 barrels of seed-sized oysters and 16,876 sacks of market-sized oysters for a combined total of 25,248 barrels of oysters. When harvest estimates within stock-assessed areas are compared with the 2011 assessments, there was an estimated utilization of 50% of the seed resource, 29% of the sack resource, and 41% utilization overall. In general, this harvest was variable throughout the Basin (Table 1.4). The majority of the observed seed harvest was from Grand Pass and Johnson Bayou Reefs at 20% respectively for both sites of the combined available seed oyster resource. The majority of market-sized resource was observed to be harvested from Three-Mile Bay and West Karako Reefs at 30% and 32% respectively of the combined available market-sized oyster resource.

Harvest amounts as well as observed vessels were not constant over time. Market oyster harvest was most prominent on the opening day of the season with an estimated 2,414 sacks harvested. The seed oyster harvest closed on November 14, 2011 with 16,810 barrels of seed collected within that two week period.

It is notable that although a large amount of harvest continues within the northeastern part of Lake Borgne, the southern and western areas of the lake continue to show no viable resource as there was no public harvest observed in those areas during the 2011/2012 season.

Table 1.5: Percent cultch sampled from vessels on public seed grounds in North Lake Pontchartrain Basin

Station	# of Vessels	Avg. Seed Estimate (bbls)/vessel	% Cultch material
Johnson Bayou	5	316	27.5%
Grand Pass	3	333	57.2%
Shell Point	2	250	64%
West Karako Bay	1	100	36.5%
Average			**43%**

While obtaining fishery dependent data, LDWF biologists collected random samples of oyster seed loads from vessels working on the public oyster seed grounds to check the percent of cultch (non-living reef material) being harvested. A total of 11 vessels were sampled. Percentages of cultch in these samples ranged from 17.6% to 94.7% with an overall average of 43% of cultch removed per bedding load. (Table 1.5) Excessive cultch take by bedding vessels remains a concern.

South Pontchartrain Basin (CSA 1S) – Oyster Stock Assessment

Introduction

The Public Oyster Seed Ground (POSG) located in the South Pontchartrain Basin (formerly CSA-2) includes areas south of the Mississippi River Gulf Outlet (MRGO) to the Mississippi River, and from the eastern extent of private leases to the Breton National Wildlife Refuge. This area encompasses approximately 300,000 of the 880,597 total acres of POSG east of the Mississippi River and includes areas designated "sack harvest only" in Lakes Fortuna and Machias, and Bay Long, as well as the Bay Gardene Public Oyster Seed Reservation. Historically this area has provided seed- and market-sized oysters for oyster fishermen both east and west of the Mississippi River. Hydrology in the area is affected at high Mississippi River stages by discharge through gaps in the levee south of Pointe a la Hache, discharge from the Caernarvon and Bayou Lamoque fresh water diversion structures, the siphon at White's Ditch, and the main-stem river distributaries in the southern portion of the Basin.

An active cultch planting program has been in effect in the area for a long period of time with recent cultch plants completed in 2007, 2009 and 2011. Numerous cultch plants have been constructed throughout the area since 1917 in places such as Bay Gardene, Bay Crabe, Black Bay, and California Bay. Currently, two additional cultch plants are planned for fall 2012 within this Basin.

Currently, this area is managed to balance the economic opportunity of the fishery with the biological sustainability of the resource. This management is contingent upon obtaining and utilizing the best fishery dependent and independent data available. This includes monitoring the harvest and resource availability throughout the fishing season and performing yearly stock assessments. The information these data provide allow resource managers to implement management changes to both effectively utilize the current resource as well as protect long term viability. This report will fulfill one of those data needs by providing estimates of the current stock size of the oyster resource within this Basin.

Methods

Samples were taken between July 2 and July 12, 2012 using a one square-meter frame randomly placed on the bottom. Divers removed by hand all enclosed live and dead oysters, as well as any exposed substrate. Live and dead oysters, spat, fouling organisms, and oyster predators were identified and enumerated. A total of 30 stations were visited with 5 square-meter replicates taken at each station. The average of the replicates was then pooled within reef systems. This average density per reef, or reef system, was then multiplied by the total area (reef acreage). The resulting number was adjusted into a barrel unit of measure where one barrel equals 720 seed-sized oysters or 360 market-sized oysters. Seed oysters are those measuring between 25 and 74 mm with market oysters being greater than 74 mm. Spat oysters are those less than 25 mm.

Results and Discussion

Seed and Sack Stock

The current stock size is estimated at 5,194 barrels (bbls) of seed oysters and 27,102 bbls of market sized oysters for a total of 32,296 bbls of overall stock. These numbers include all of the currently assessed reefs (Figure 2.1). Overall abundance is down 62% from last year, down 95% from the 10 year average (2002 - 2011), and down 98% from the long term average (1982 – 2011)**.** Seed oyster stock is down 67.8 % from last year, and is the lowest estimated abundance since 1982. Sack oyster stock is down 60.1% from 2011 and is 91% below the past ten years' average, and 95.4% less than the long-term average (1982 – 2011) (Figure 2.2).

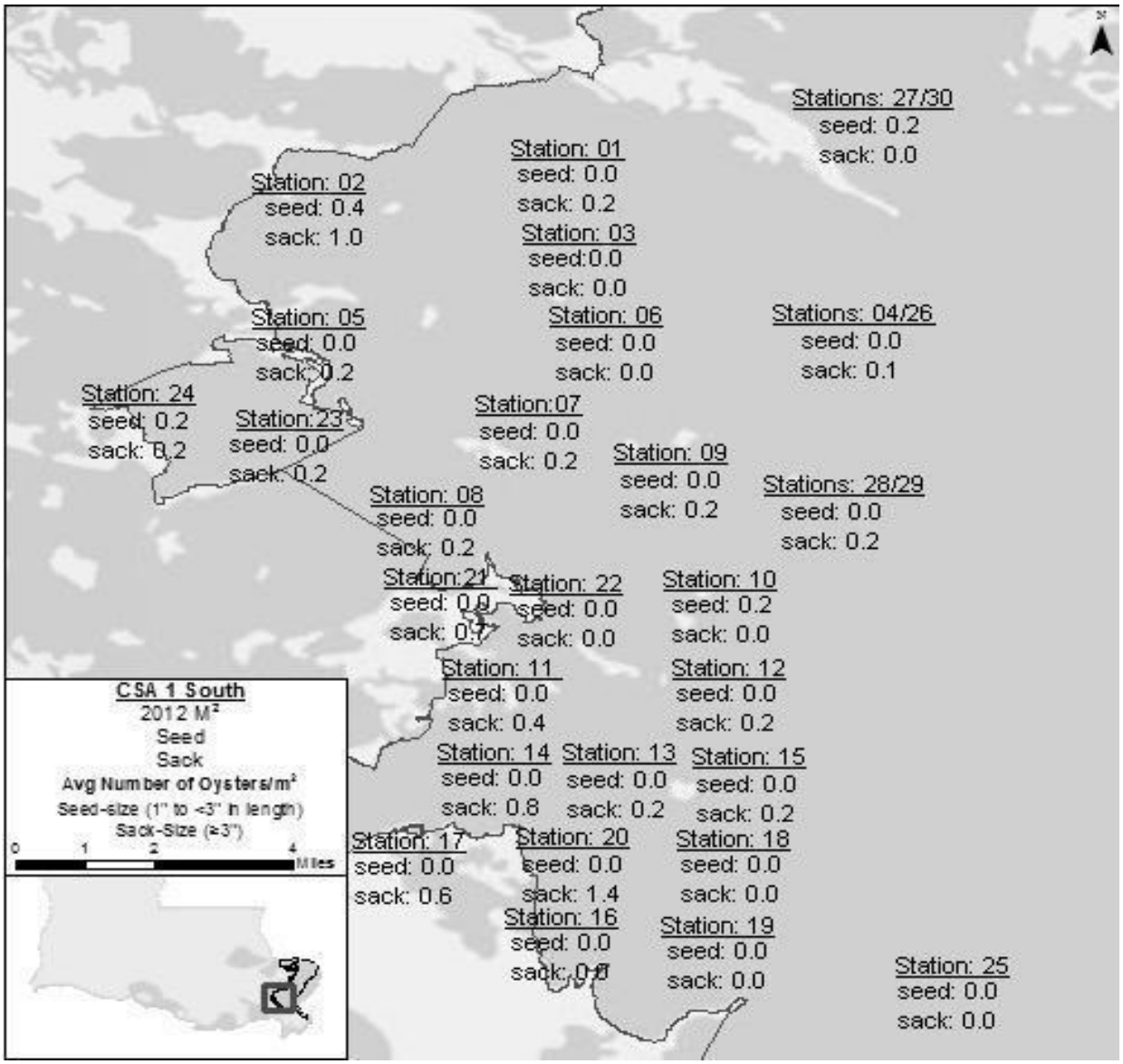

Figure 2.1 Map Showing assessment stations within the South Pontchartrain Basin; Numbers below stations are average numbers of seed and sack oysters per m^2

Oyster density and abundance was not evenly distributed among areas (Table 2.1) with the highest density of seed oysters found at Jessie's Island and highest abundance within the sacking only area in Lake Fortuna. The highest density of sack-sized oysters was located in West Pelican with the highest total abundance found at The Wreck reef system.

As earlier stated, seed-sized oyster stock decreased significantly from 2011 levels and seed oysters were not found at 26 of the 30 stations sampled for this assessment. Approximately 92% of seed oysters are located in the Lake Fortuna area, which has been historically designated as sacking only (not available for bedding).

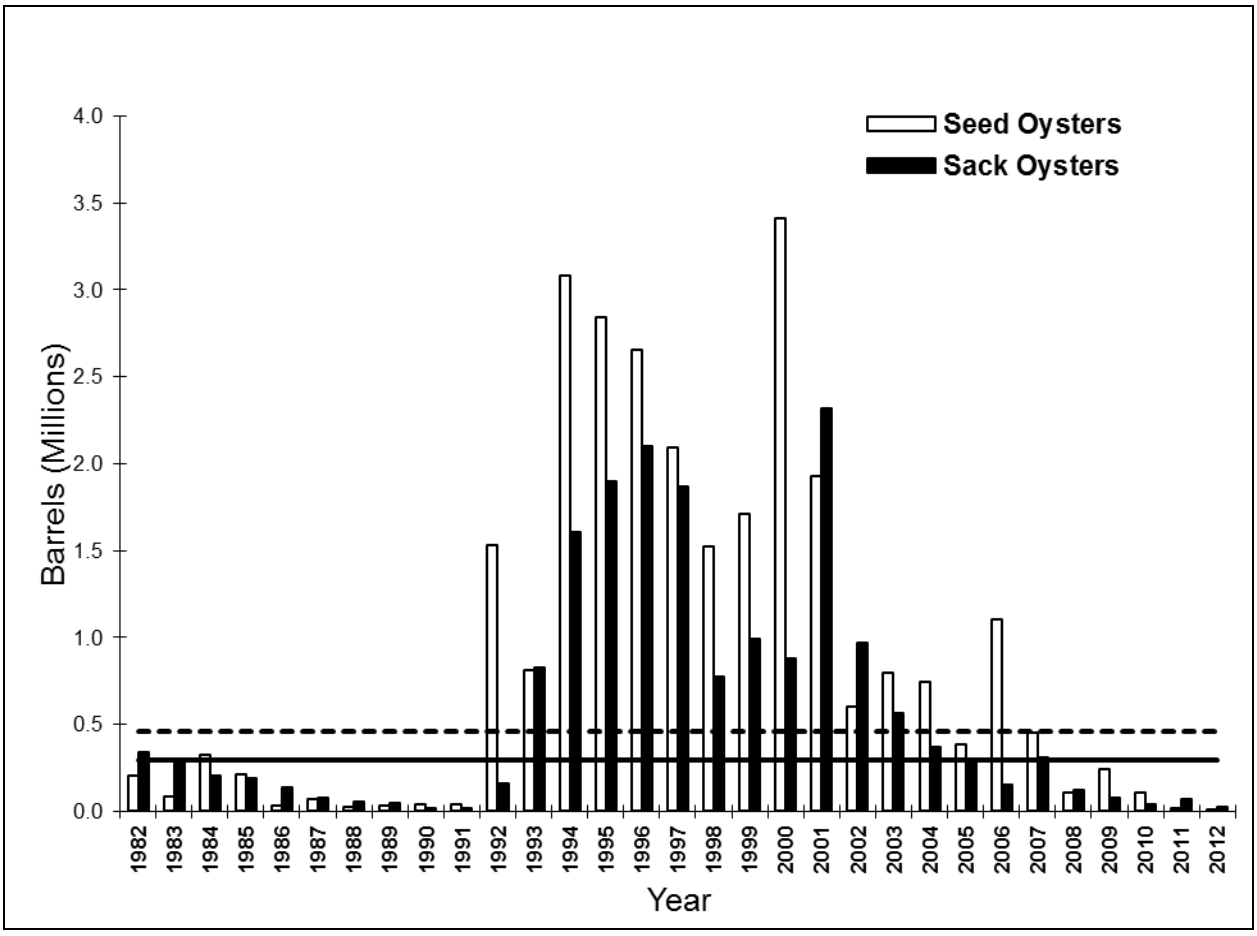

Figure 2.2. Current and historical Stock Assessment values; Horizontal lines represent the previous ten-years' seed and sack average

Spat Production

Live spat were observed at only 3 of the 30 stations sampled during this assessment. Densities at these 3 stations ranged from 0.2 to 17.4/m^2. Although these assessment events may occur outside of the peak spawning period, it is evident that there has been no spring and only marginal summer spat catch on these reefs. This marks a continuation of poor to no spat catches within this Basin. This may be attributed to several causes discussed below.

Mortality

Spat mortalities ranged from 2.3 to 100% at the 3 stations where spat were observed. There was no seed mortality observed, though it is worth noting that seed occurred at only 4 stations. There was no sack-sized mortality noted in the assessment samples, but sample sizes were extremely low.

Table 2.1. Mean densities of oysters collected at South Pontchartrain Basin sites.

Stations		Reef Group Acreage	Square Meters	Live Seed Oysters/m^2	Live Sack Oysters/m^2	Seed Oyster Availability(bbls)	Sack Oyster Availability(bbls)	Oyster Spat/m^2
1	**Snake**	506	2,047,782	0.0	0.2	0	1,138	0.0
2	**Jessie**	59	238,773	0.4	1.0	133	663	0.0
3	**N. Lonesome**	896	3,626,112	0.0	0.0	0	0	0.0
5	**Bayou Lost**	118	477,546	0.0	0.2	0	265	0.0
6	**Lonesome**	716	1,914,231	0.0	0.0	0	0	0.0
7	**Black Bay**	301	1,218,147	0.0	0.2	0	677	0.0
8	**W. Bay Crabe**	501	2,027,547	0.0	0.2	0	1,126	0.0
9	**Stone**	461	1,865,667	0.0	0.2	0	1,036	0.0
10	**S. Black Bay**	145	586,815	0.2	0	163	0	0.0
11	**Elephant**	339	1,371,933	0.0	0.4	0	1,524	0.0
12	**Curfew**	425	1,719,975	0.0	0.2	0	956	0.0
13	**N. California**	109	441,123	0.0	0.2	0	245	0.0
14	**California**	7	28,329	0.0	0.8	0	63	0.0
16	**Sunrise**	174	704,178	0.0	0.0	0	0	0.0
17	**Bay Long**	572	2,314,884	0.0	0.6	0	3,858	0.0
19	**Mangrove**	937	3,792,039	0.0	0.0	0	0	0.0
20	**W. Pelican**	293	1,185,771	0.0	1.4	0	4,611	0.0
21	**Bay Crabe**	659	2,666,973	0.0	0.7	0	4,964	0.0
22	**E. Bay Crabe**	122	493,734	0.0	0.0	0	0	0.0
23	**E. Gardene**	28	113,316	0.0	0.2	0	63	0.0
24	**Bay Gardene**	69	279,243	0.2	0.2	78	155	0.0
4,26	**N. Black Bay**	315	1,274,805	0.0	0.1	0	354	4.2
15	**Telegraph**	127	513,969	0.0	0.2	0	286	0.0
18	**E. Pelican**	782	3,164,754	0.0	0.0	0	0	0.0
25	**Battledore**	1419	5,742,693	0.0	0.0	0	0	0.2
27,30	**L Fortuna**	4288	17,353,536	0.2	0.0	4,820	0	17.4
28,29	**Wreck**	2276	9,210,972	0.0	0.2	0	5,117	0.0
2012 TOTALS		**16,644**				**5,194**	**27,102**	

	2011	2012	% Change
Seed	16,148	**5,194**	**-67.8%**
Sack	68,725	**27,102**	**-60.1%**
Total	**84,873**	**32,296**	**-62.0%**

Deepwater Horizon Oil Spill and Related Response Actions

The *Deepwater Horizon* oil spill released millions of barrels of oil into the Gulf of Mexico affecting the Louisiana coastline, including oyster habitat. In direct response to the spill, in an

effort to keep incoming oil from the Gulf out of Louisiana's sensitive marshes and estuaries, freshwater was released from diversions and siphons along the Mississippi River. The impacts of oil and freshwater diversions on oyster health and habitat continue to be of concern. Assessment continues on the direct and indirect impacts of oil and response actions to Louisiana's near shore environment, including to oysters and oyster habitat.

Fouling Organisms

Hooked mussels (*Ischadium recurvum*) are a sessile bivalve that is oftentimes associated with oyster reefs and compete with oysters for food and settlement surfaces. During the assessment samples hooked mussels were present at each station and ranged in density from 10.0 to 2,314.4 individuals / m^2 (Table 2.2) . Overall hooked mussel density has increased over the previous assessment with the largest increase in density coming from reefs in California Bay at Sunrise Point. Marginal decreases were noted at only 4 of our 30 stations. Additionally, Spionid polychaetes mud tubes, ctenostome and fairy lace bryozoans, the tube dwelling amphipod, *Apocorophium*, and other small hydroids have been indentified on live oysters and the exposed shell in the assessment area. This covering appears to be a limiting factor for the attachment of oyster larvae to the substrate.

Table 2.2. Mean density of the hooked mussel, *Ischadium recurvum*, and the southern oyster drill, *Stramonita haemastoma*, at each station.

Station	*I. recurvum* density/(m^2)	*S. haemastoma* density/(m^2)
1 Snake	293.6	0
2 Jessie	248.2	0
3 N. Lonesome	169.4	0
5 Bayou Lost	51.2	0
6 Lonesome	57.8	0
7 Black Bay	310.6	0
8 W. Bay Crabe	400.0	0
9 Stone	364.4	0
10 S. Black Bay	176.8	0
11 Elephant	676.2	0
12 Curfew	322.6	0
13 N. California	568.2	0
14 California	276.8	0
16 Sunrise	2314.4	0
17 Bay Long	207.6	0
19 Mangrove	539.4	0
20 W. Pelican	572.6	0
21 Bay Crabe	375.8	0
22 E. Bay Crabe	10.6	0
23 E. Gardene	237.4	0
24 Bay Gardene	685.2	0
4, 26 N. Black Bay	104.4	0.1
15 Telegraph	606.2	0
18 E. Pelican	197.0	0
25 Battledore	10.0	0
27, 30 Lk. Fortuna	114.7	0.8
28, 29 Wreck	187.5	0.4

Oyster Predators/Disease

The southern oyster drill (*Stramonita haemastoma*) is a predatory marine gastropod known to prey on oysters and other sessile animals using a small tooth-like scraping organ called a radula to bore a hole through the oyster shell. Snails were found at three stations (the Wreck, Lake Fortuna, and North Black Bay) with no egg cases found in any of the samples. The recent extended periods of low salinity may have limited snail abundance in the area. Two stone crabs (*Mennipe adinia*), and no blue crabs (*Callinectes sapidus*) were observed in the samples.

Perkinsus marinus (= dermo), a protozoan parasite that infects oyster tissue, is known to cause extensive oyster mortalities especially under high salinity and high water temperature conditions. Dermo samples were attempted at 7 stations throughout the area. Of those seven stations only four contained sufficient sack-sized oysters and none contained enough oysters for a seed-size analysis. Results of Dermo tests are presented in a separate section of this document.

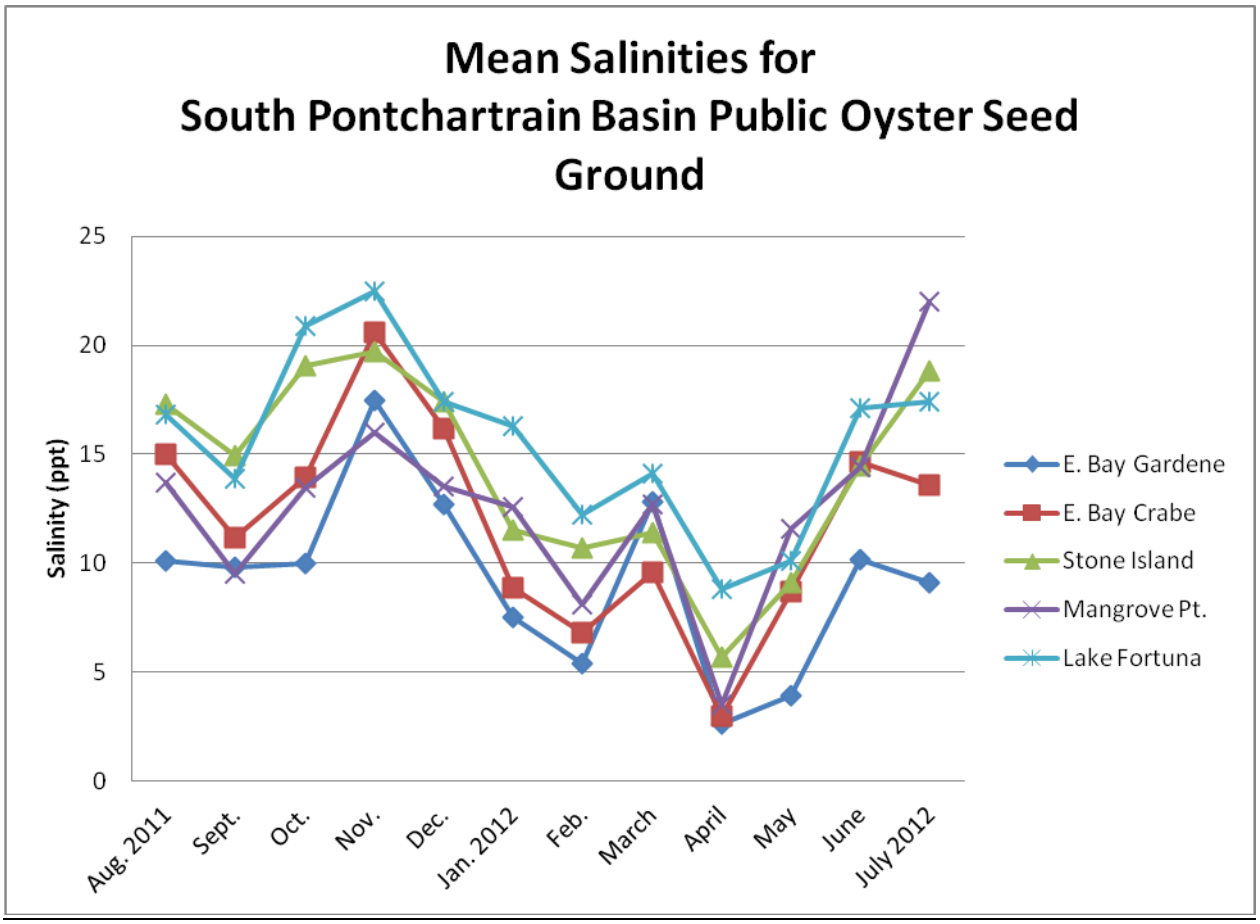

Figure 2.3. Salinity data collected for the South Pontchartrain Basin Public Oyster Seed Grounds since the 2011 assessment. Data presented are from discrete measurements on each reef.

Tropical and Climactic Events

There were no substantial tropical systems impacting the northern Gulf of Mexico during the assessment period. The main input of freshwater to the Basin was from discharge through fresh

water diversion structures and through gaps in the levee south of Pointe a la Hache, as well as main-stem distributaries during high Mississippi River stages. There was an increase in flow rate to approximately 7,500 cfs at the Caernarvon Fresh Water Diversion structure for a 14 day period beginning on March 29, 2012. Salinities across the entire Basin were consistently at or above the 8 parts per thousand (ppt) mark throughout most of the assessment year. (Figure 2.3) There were notable decreases in salinity Basin-wide during the months of February and April 2012. During this period salinities at E. Bay Gardene, E. Bay Crabe, and Mangrove Pt. fell to 2.6, 3.0 and 3.5ppt respectively. Only the E. Bay Gardene site remained below 5ppt in May, and all sites had recovered and were above 10ppt by June.

2011/2012 Oyster Season Summary

The 2011/2012 oyster season in the South Pontchartrain Basin POSG opened on October 31, 2011 for the harvest of sack and seed oysters. Seed oyster harvest was closed on November14, 2011. The harvest of sack oysters was closed on February 2, 2012.

Cumulative Impacts and Mortalities

This section will focus on greater detail concerning environmental conditions observed, as well as direct impacts that have occurred since the previous stock assessment in 2011. It is also important to note that many of the topics listed below are correlated with one another, i.e. freshwater inputs-salinity stratification-hypoxia.

Hypoxia

The definition of hypoxia varies as it is based on the percent saturation of water by oxygen. This varies with temperature and amount of other solutes. For most environmental assessments in this area, hypoxia can be viewed as concentrations of dissolved oxygen below 3 milligrams per liter (mg/L). As oysters are a sessile species, reef systems can often be impacted by hypoxia in an estuarine setting. Within the Pontchartrain Basin estuary, the most common driver of hypoxia over reef systems is the stratification of the water column due to density differences in water masses. These density differences are oftentimes driven by salinity and temperature. Basically, warmer, fresher water overrides denser salt water and does not allow the diffusion of oxygen throughout the water column. This is common in areas that have experienced high fresh water inputs, especially after the return of higher salinity waters once fresh water inputs subside. In other cases, in relatively confined areas, increases in biological oxygen demand can also lead to hypoxia, although localized. Some instances of hypoxia are "usual" in most areas, but prolonged exposure can result in reduced growth, decreased disease resistance, or direct mortality. At the time of the 2012 assessment, only the California Bay area was experiencing a period of hypoxia as was evidenced by a average monthly dissolved oxygen measurement of 1.9 mg/L at Mangrove Pt. (Figure 2.4)

Freshets

While freshets often provide benefits to the reef system, either by reducing disease or predation, or enhancing cultch opportunities, we must also realize that other variables are also operating at the same time. The impact/recovery is also modified by not only the magnitude of a freshet, but also the duration and timing. Specifically this area has experienced two such events over the assessment period occurring during, or very near, peak spring spawning times.

Sedimentation/Subsidence

During periods of high freshwater input sedimentation over reefs can be a problem. This sedimentation can affect the reef either through direct mortality (burial) or through reduced growth and reproduction (both production and clean places for larval attachment). During the 2012 assessment, divers noted that 2at some sites, cultch had a covering of silt. These conditions limit the amount of suitable substrate available for larval settlement.

Subsidence of the reefs is usually balanced by reef accretion or growth. If no appreciable shell is added over a period of time, the reefs, especially those in less than optimal environments, will subside to the point of shell burial. The lowering of the reef profile also subjects associated organisms to more frequent hypoxia events as well as changing the local water flow and sedimentation processes.

Cultch Condition

Any successful spat set is dependent upon clean, stable cultch for larval attachment. The condition of the cultch and live oyster shell within the South Pontchartrain Basin currently appears to be poor. As noted above, a few areas are buried or covered with a thin layer of silt. On some reefs within the Basin, the cultch is covered at least partially by fouling organisms such as Spionid polychaete mud tubes, ctenostome and fairy lace bryozoans, the tube dwelling amphipod, *Apocorophium*, and small hydroids, all of which can pose hindrance to larval oyster settlement. In other areas, the addition of shell to a reef has become so infrequent that the cultch on hand is being transformed into small "hash" particles that do not provide optimal substrate for larval attachment.

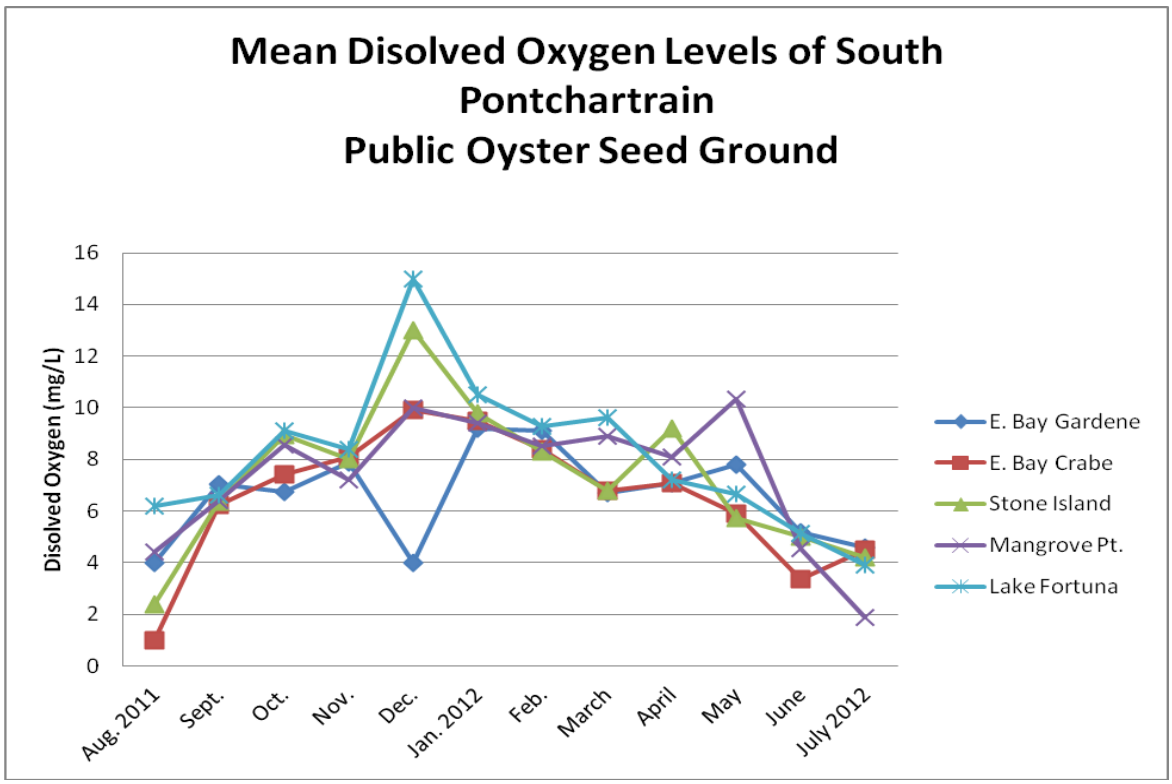

Figure 2.4. Dissolved oxygen data collected for the South Pontchartrain Basin Public Oyster Seed Grounds since the 2011 assessment. Data presented are from discrete measurements on each reef.

Harvest Monitoring Methods

Fishing effort was observed on the South Pontchartrain Basin POSG during the 2011/2012 season by the following method: Harvest totals were estimated by obtaining fisheries dependent data from the monitoring of users. "Boarding Surveys" were conducted weekly during the season. LDWF Biologists survey the entire area observing fishermen, recording locations, and making harvest estimates for each vessel for that day. This estimate is projected over the amount of "fishable days" (winds less than 25 mph) for the week and a total harvest of seed and market oysters for the week is made. Vessels collecting seed are often boarded to determine if excessive amounts of cultch (non-living reef material) are being removed from area reefs. Harvest data is also obtained via the trip ticket system in place for this fishery. However, this data is consolidated by geographic region and is considered preliminary until well after the season concludes, and provide a limited resolution. As the season progressed, weekly board run survey data indicated that at early 2012 harvest rates, a theoretical 100% harvest of available stock was approached and the season was subsequently closed. In order to protect remaining oyster resources, an emergency closure of all the Public Seed Grounds east of the Mississippi River was issued effective one-half hour after sunset on Thursday, February 2, 2012.

Harvest Results and Discussion

Harvest totals for market sized oysters in 2011/2012 were estimated at 91,342 sacks (45,671 barrels). Sack harvest effort was distributed throughout the area as follows: Bay Gardene at 4%, Black Bay at 20%, Bay Crabe at 14%, Lake Fortuna at 27%, Bay Long at 12%, and California Bay at 20% and the remainder on 2007 and 2009 cultch plants. Harvest totals for seed were estimated at 19,350 barrels. Estimated harvest was down from previous seasons but represented approximately 120 % utilization of the estimated available seed from the 2011 stock assessment.

The majority of seed harvested came from Bay Crabe at 48%, followed by Black Bay at 21%, and California Bay at 18%. Seed harvest closely followed effort: Bay Crabe at 49%, followed by Black Bay at 23%, and California Bay at 19%. Harvest totals for seed and sack combined in 2011/2012 were estimated at 65,021 barrels. This still represented a 77.0% utilization of estimated available resource for 2011/2012.

While obtaining fishery dependent data, LDWF biologists collected random one cubic-foot samples of seed oyster loads from vessels working on the public oyster seed grounds to check the percent of cultch (non-living reef material) being harvested. A total of 12 vessels were sampled, with 5 replicate samples obtained from each vessel. Percentages of cultch observed ranged from 19.4 - 86.5% (unaveraged replicates) with an overall average cultch take of 50.3 % per bedding load. Excessive cultch removed from public reef systems by bedding vessels remains a concern for the South Pontchartrain Basin.

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Coastal Study Area (CSA) 3 – Oyster Stock Assessment

Introduction

For the purpose of oyster management, Coastal Study Area (CSA) 3 consists of three public oyster areas distributed generally in a north-south direction within the Barataria Bay estuary: 1) Little Lake Public Oyster Seed Grounds, 2) Hackberry Bay Public Oyster Seed Reservation, and 3) Barataria Bay Public Oyster Seed Grounds. Hackberry Bay is the oldest of the three as it was designated by the Louisiana Legislature as a public oyster seed reservation in 1944. Barataria Bay was designated by the Louisiana Wildlife and Fisheries Commission (LWFC) as a public oyster seed ground in 2000, and Little Lake was designated by the LWFC in 2007. Coastal Study Area 3 (CSA 3) has historically monitored three sampling sites for annual oyster stock assessment, all in Hackberry Bay. Sampling has expanded in recent years, however, with the addition of the Barataria Bay Public Oyster Seed Ground, and the addition of newly constructed oyster reefs in Hackberry Bay.

Hackberry Bay (Jefferson/Lafourche Parishes) is an approximately 4,402 acre mesohaline lake with a mostly soft silt and clay bottom, of which approximately only 14.7 acres is naturally occurring reef material. The three historical sampling sites within Hackberry Bay are the upper, middle, and lower Hackberry sampling sites. The middle Hackberry site is the only site located over historical existing reef while the upper and lower sites are over former cultch plants placed on top of historical reefs. The upper Hackberry sampling site was the result of a 1994 cultch plant using federal disaster funds from Hurricane Andrew in 1992. The upper site had also been the location of cultch plants in 1943 (140 acres), 1945 (70 acres), 1946 (92 acres) and 1981 (67 acres). The 1994 cultch site was comprised of six different sections of substrate for a total of 145 acres. The substrates were crushed concrete, shucked shell, reef shell, mixed shell, Kentucky limestone and Bahamian limestone. The lower Hackberry sampling site is on a reef that was part of a 450 acre 1973 cultch plant. Since very little natural reef exists in the Hackberry Bay Public Oyster Seed Reservation, production is highly dependent upon and reflective of when and where cultch plants are placed in the bay. It is unknown how much, if any, cultch material from the 1994 and earlier cultch plants remains exposed above the surface of the mud. Therefore, the acreage of these cultch plants is not factored into the annual oyster stock assessment.

In response to impacts from Hurricane Lilly in 2002, two cultch plants were placed in Hackberry Bay in 2004. The northern Hackberry Bay cultch plant, 10 acres, was planted near the old 1994 cultch plant on May 10, 2004 using approximately 2,322 cubic yards of #57 limestone. The southern Hackberry Bay cultch plant, 25 acres, was planted between May 10 and 12, 2004 using approximately 4,005 cubic yards of #57 limestone.

In 2008, a new cultch plant was placed in the northeastern portion of Hackberry Bay using federal funds dedicated to the impacts of Hurricanes Katrina and Rita. The 2008 cultch plant is approximately 50 acres in size and was planted between May 20 and 25, 2008 using Approximately 75% #57 limestone, 15% crushed concrete, and 10% cleaned oyster shell. The total amount of material was approximately 10,171 cubic yards weighing approximately 13,223 tons.

On May 13 thru 21, 2012, utilizing early restoration funds following the BP oil spill, 26,086 cubic yards of limestone were placed on approximately 200 acres in the northwest portion of Hackberry Bay at a cost of $56.93 per cubic yard. This increased the estimated reef acreage on the Hackberry Bay Public Oyster Seed Ground from 99.7 to 299.7 acres.

The Barataria Bay Public Oyster Seed Ground was designated as a public oyster ground in response to possible changes in the salinity regime of the estuary stemming from the Davis Pond Freshwater Diversion project. Davis Pond is a large Mississippi River diversion project that aims to reintroduce freshwater and nutrients into the Barataria Bay estuary. As this new coastal restoration project was anticipated to reduce salinities in the estuary, Louisiana Department of Wildlife and Fisheries (LDWF) felt that an additional public oyster seed ground farther down-estuary may be productive during years with high freshwater input. The only known reef in existence on the Barataria Bay Public Oyster Seed Ground is a 40-acre reef constructed in 2004 utilizing Coastal Impact Assistance Program (CIAP) and Oyster Seed Ground Development Account (compensation from oil and gas impacts) funding. The reef is comprised of approximately 7,536 cubic yards of crushed concrete. The Barataria Bay cultch plant was placed onsite from May 6 to 8, 2004 and is located in the northeast section of the Barataria Bay Public Oyster Seed Ground. It is vulnerable to predators such as oyster drills and other stressors (i.e. Dermo) associated with higher salinities. Consistent production cannot be expected until salinity regimes in the basin change due to natural forces or coastal restoration efforts.

On February 1, 2007 the Wildlife and Fisheries Commission created the Little Lake Public Oyster Seed Ground. This area had been utilized in the past as a temporary natural reef area, last in 2004, and was once covered with private oyster leases. These leases all fell within the Davis Pond freshwater diversion impact area and were either purchased or moved by the state and federal government prior to the opening of Davis Pond. Davis Pond has not been consistently utilized to its maximum capacity since it first opened in 2002, and environmental conditions during some years have allowed oysters to continue to exist in Little Lake. Therefore, the LWFC designated this area a public oyster ground so that oysters could be harvested and reefs could be actively managed by LDWF. The location of the Little Lake POSG makes it vulnerable to freshwater input from the northern portion of the basin such as heavy rainfall, freshwater input from the Intracoastal Waterway and outflow from the Davis Pond freshwater diversion. Reduced salinities caused by these sources of freshwater can have a negative impact on oyster survival and availability. However, when higher salinities in the northern portion of the basin exist the Little Lake Public Oyster Seed Ground has allowed the oyster industry access to additional seed and sack oysters in the Barataria Bay basin. Although very little information on reef acreage exists for Little Lake, LDWF hopes to embark on a water bottom assessment of the area in the future.

Materials and Methods

Samples used in this assessment were collected by CSA 3 staff on July 2, 5, and 6, 2012. Samples were taken using a one square-meter frame placed randomly on the bottom over reef at each sampling location. Using SCUBA, all live and dead oysters, as well as shell, in the upper portion (exposed) of the substrate were removed from the area enclosed in the frame. Live and dead oysters, spat, fouling organisms, and oyster predators were identified and enumerated. All oysters were measured in 5 millimeter work groups and divided into size groups of spat (0-24mm), seed (25-74mm), and sack oyster (75mm and greater). Seven stations were visited

(Figure 3.1) with five replicate square meter samples taken at each location. Five replicate ¼ meter samples were also taken at random locations on the 2012 cultch plant in Hackberry Bay. All live and dead oysters as well as limestone in the frame were removed by SCUBA divers. Live and dead oysters, spat, fouling organisms and oyster predators were identified and counted. Oysters were measured and categorized by size. The average of the five samples at each station was used, in combination with reef acreage, to estimate the current oyster availability for CSA 3.

The Little Lake Public Oyster Seed Ground was not sampled due to lack of reef acreage information.

Results and Discussion

Seed and Sack Stock

Stock for the Hackberry Bay Public Oyster Seed Reservation, including the 2004, 2008 and 2012 cultch plants, is estimated at 10,513 barrels of seed size oysters and 11,046 barrels of market size oysters for a total of 21,559 barrels of overall stock. Seed were present at all stations except lower Hackberry. Seed availability is down approximately 42.7% from 2011, 124% above the past 10 year average, but 26.5 % below the long term average since 1976. Sack oysters were present at all stations with the exception of the new 2012 cultch plant. Market stock was up approximately 274 % from 2011, 541 % above the past 10 year average, and 38.2 % above the long term average since 1976 (Table 3.1, Figure 3.2). Combined stock increased approximately 1.2% over last year, is 236.1% over the 10 year average, but is 3.3 % below the long term average since 1976. Seed oysters averaged 2.2 inches with approximately 76% in the 2-3 inch size range. Sack oysters averaged 3.75 inches with approximately 66.7 % in the 3-4 inch size range. No live spat, seed or sack oysters were observed in the Barataria Bay Public Oyster Seed Ground (Figure 3.1, Table 3.1). Market-size oyster availability has not been documented on the Barataria Bay POSG since it was created in 2004.

Spat Production

Live spat were present at all stations in Hackberry Bay and ranged from 0 to 228 spat per square meter with an average catch of 34.3. This is well above the long term average since 1975 (7.6 spat/frame) but below last year's average of 47.2 spat per square meter. The highest numbers were found at the 2012 cultch plant. 93.8% of spat observed were less than ½ inch.

No live spat were observed in the Barataria Bay Public Oyster Seed Ground. Grit was observed on the surface of the reef substrate and may be a result of deteriorating crushed concrete, the cultch material utilized to construct the reef. Since the reef construction in May 2004, the only stock assessments with a record of spat were in the assessments of 2005 (8 spat per M^2), 2009 (53.5 spat per M^2), and 2010 (5.2 spat per M^2).

Fouling Organisms

The hooked mussel (*Ischadium recurvum*), is a reef-associated benthic bivalve species that competes with oysters for food and settlement surfaces. Hooked mussels were present at all sampling locations located in Hackberry Bay with the exception of the 2012 cultch plant. Highest densities were observed at the 2004 South cultch plant (Table 3.2). The average number of hooked mussels observed in the Hackberry Bay POSR was 9.6 per square meter. This

represents a decrease over last year's average of 31.2 per frame and may be attributable to higher salinities in the bay. (Figure 3.8)

No hooked mussels were found in any of the Barataria Bay POSG samples.

Mortality
Recent spat mortality at each station on the Hackberry Bay POSR ranged from 1.3% to 76.9% with an overall average of 3.8 %. Recent seed oyster mortality at each station ranged from 0% to 100% averaging 5.2%. No recent mortalities in sack size oysters were observed (Table 3.2).

No live or recently dead spat, market size, or seed oysters were observed on the Barataria Bay POSG.

Additional sources of oyster mortality data available since the 2011 oyster stock assessment include the on-going Nestier tray project which places oysters in trays at multiple sites throughout the Barataria basin in January. Mortality data is recorded from the trays on a monthly basis. By the end of June 2012, oyster mortality on the Nestier trays placed in Hackberry Bay in January 2011 was 0%. One hundred percent mortality was observed at tray sites in Grand Terre Bay and Cat Bay.

Oyster Predators
The Southern oyster drill (*Stramonita haemastoma)* is a predatory marine snail that feeds on oysters and other sessile organisms using a radula (a small tooth-like rasping organ) to bore a hole through the shell. Snails were observed in four out of five frames at the 2004 Barataria Bay cultch plant (five snails total).

Tropical and Climatic Events
According to data supplied by the Tarbert gauge at the United States Army Corps of Engineers (USACE) website, Mississippi River flow in July, August, and September 2011 was above the long term average (1961 to 2010). Levels dropped slightly below the average in October and November before rising in December 2011, January, February, and March 2012. Levels dropped below average in March and have remained so through June. (Figure 3.4).

According to the United States Geologic Survey (USGS) constant data recorder located near the structure, Davis Pond monthly flow averaged 1,997 cubic feet per second (cfs) from July 2011 to June 2012 with flow rates varying between 556 cfs and 3,771 cfs. Average monthly flow rates were above the long term average (2003 to 2010) in July 2011, and from October 2011 to February 2012. Average monthly flow rates were below average from March through June 2012. (Figure 3.5).

On September 4, 2011 Tropical Storm Lee made landfall approximately 50 miles southwest of Lafayette with maximum sustained winds of 45 mph. Lee was downgraded to a tropical depression on September 5th and was primarily a rainfall event for the area registering 14.56 inches at the Carrolton gauge in New Orleans. No other tropical systems have affected the study area since the 2011 stock assessment.

Louisiana rainfall during the time period of July 2011 through June 2012 was below normal in August, and from October through January. Rainfall during that same time period was above

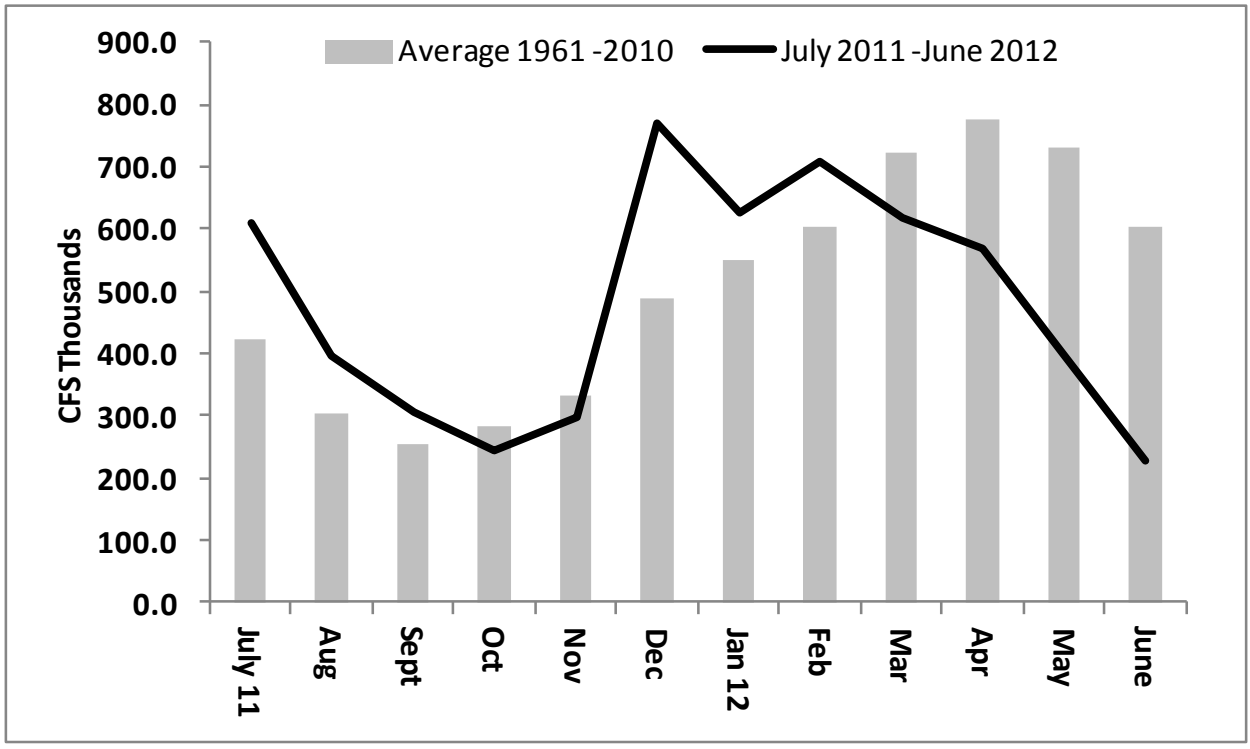

Figure 3.4 Mississippi River discharge in thousands of cfs. Mississippi River discharge data supplied by the United States Army Corps of Engineers (USACE).

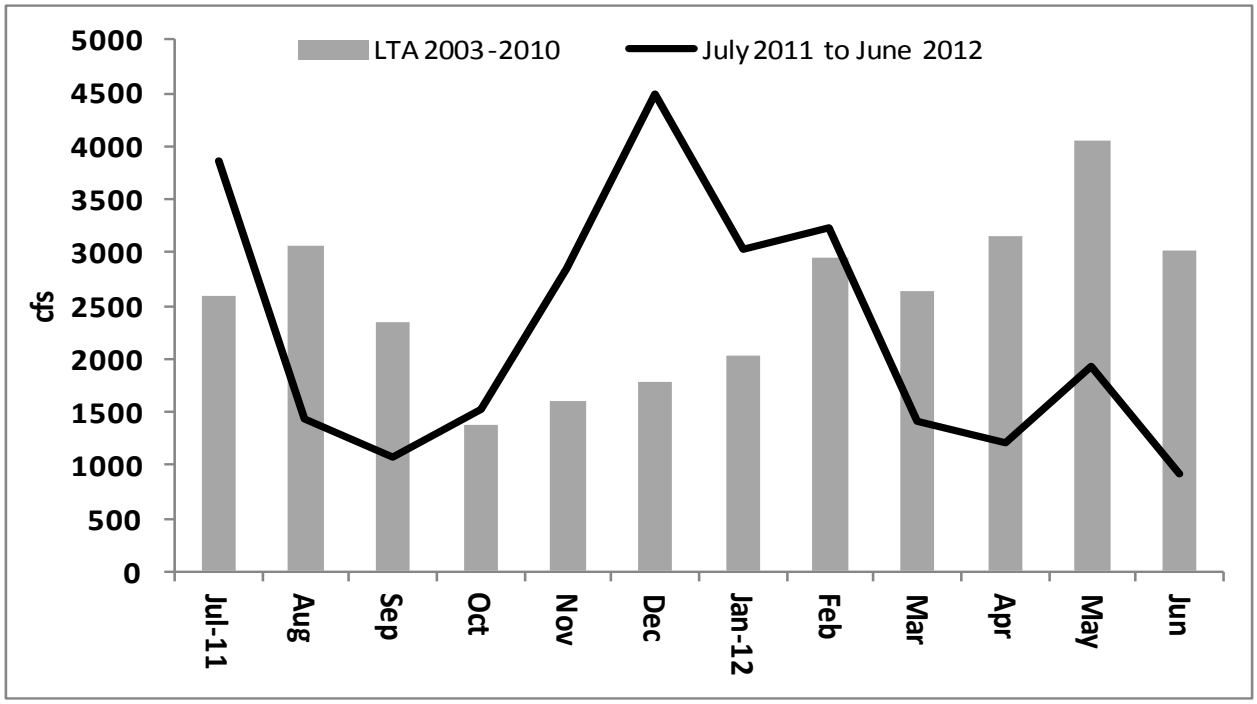

Figure 3.5 Davis Pond discharge in cubic feet per second (cfs) Davis Pond discharge data supplied by the United States Geological Survey (USGS) constant data recorder located near the Davis Pond structure.

normal in July, September (tropical storm Lee), March, and April, and near normal in February and June (Figure 3.6).

Hackberry Bay POSG salinities from July 2011 to June 2012 averaged 11.1 ppt. with a range of 4.5 to 19.1 ppt. (Figures 3.8, 3.9). The average for June 2012 was 17.5 ppt. which is well above the June monthly average from 1996 to 2011 of 10.98 ppt (Figure 3.7).

Salinities in the Barataria Bay POSG for the same period averaged 18.6 ppt. with a range of 11.3 to 27.9 ppt. (Figure 3.9). The average salinity in June was 22.4 ppt.

Salinities in the Little Lake POSG averaged 5.2 ppt. between July 2011 and June 2012 with a range from 1.6 to 14.3 ppt. (Figure 3.9). Average June 2012 salinity in the Little Lake POSG was 3.0 ppt.

Deep Water Horizon Oil Spill and Related Response Actions
The BP Deepwater Horizon oil spill released millions of barrels of oil into the Gulf of Mexico affecting the Louisiana coastline, including oyster resources. In direct response to the spill, in an effort to keep incoming oil from the Gulf out of Louisiana's sensitive marshes and estuaries, freshwater was released from diversions and siphons along the Mississippi River. The impacts of oil and freshwater diversions on oyster health and habitat continue to be of concern. Assessment continues on the direct and indirect impacts of oil and response actions to Louisiana's near shore environment, including to oysters and oyster habitat.
Areas around Bay Jimmy, Grand Terre and the mouth of the Mississippi river remain closed due to impacts from the BP MC252 spill.

<u>2011/2012 Oyster Season Summary</u>
The Little Lake Public Oyster Seed Grounds opened on September 7, 2011 and closed on April 30, 2012.

The opening of the 2011/2012 season in the Hackberry Bay POSG and Barataria Bay POSG was originally set for October 17, 2011. The opening was delayed until October 31st to allow for continued sampling as part of the BP Deepwater Horizon Natural Resource Damage Assessment. The Hackberry Bay and Barataria Bay seed grounds remained open for 5 days closing on November 4, 2011.

Total harvest from public grounds in CSA 3 during the 2011/2012 season was estimated at 1,674 barrels of seed oysters with 99% of seed harvest and 100% of the sack harvest coming from Hackberry Bay (Table 3.3).

The removal of excess reef material from public reefs during seed-oyster harvest is a concern to LDWF biologists. The practice continues to threaten the long-term sustainability of the oyster resource on the public grounds. To assess the amount of reef material being removed, three random samples from vessels harvesting from the public grounds were collected and a subsample from each of those three random samples was measured using a one cubic foot aluminum container. In each subsample, any material having any live seed or sack oysters was separated from material without live oysters. Large clusters were culled. The percentage of cultch removed was calculated by dividing the weight of the material without seed or sack oysters by the total weight of the material contained in the cubic foot container. Data from the

three samples were averaged to obtain a percent cultch estimate for each vessel. Fifteen vessels were sampled and samples taken to determine the percent of non-living reef material removed from the reefs. The percent of non-living reef material removed by the sampled vessels ranged from 0 to 50.4%. The overall average of non-living reef material removed was 17.8%.

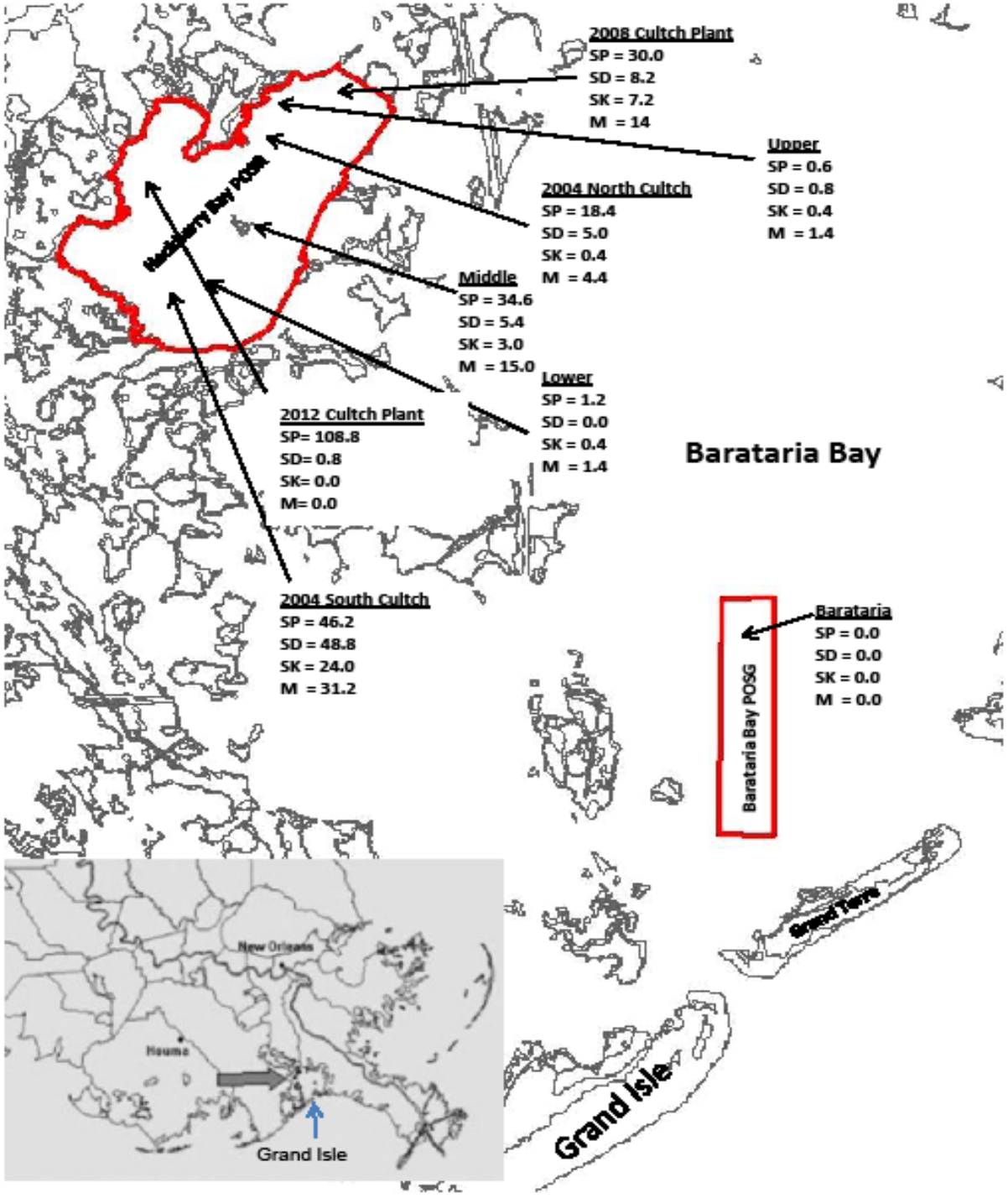

Figure 3.1 2012 Hackberry Bay POSR and Barataria Bay POSG sample results as an average per square meter (SP=Spat, SD=Seed, SK=Sack, and M=Mussels) and map of sample locations.

Table 3.1 2012 square meter results for the Barataria Basin (CSA 3).

Station	No.	Approx Reef Acres	Average Live Seed Oysters / M2	Average Live Sack Oysters / M2	Barrels of Seed Available	Barrels of Sack Available	Oyster Spat/M2
Hackberry Bay 2004 North Cultch Plant	6	10	5.0	0.4	281.0	45.0	18.4
Hackberry Bay 2004 South Cultch Plant	7	25	48.8	24.0	6,857.2	6,744.8	46.2
Hackberry Bay 2008 Cultch Plant	9	50	8.2	7.2	2,304.5	4,046.9	30.0
Hackberry Bay 2012 Cultch Plant	10	200	0.8	0.0	899.3	0.0	108.8
Lower Hackberry Bay	1	4.9	0.0	0.4	0.0	22.0	1.2
Middle Hackberry Bay	2	4.9	5.4	3.0	148.7	165.3	34.6
Upper Hackberry Bay	3	4.9	0.8	0.4	22.0	22.0	0.6
Barataria Bay 2004 Cultch Plant	8	40	0.0	0.0	0.0	0.0	0.0
Little Lake		Unknown	Unknown	Unknown	Unknown	Unknown	
Totals		339.7			10,512.8	11,045.9	

	2011	2012	% Change
Seed	18,341.2	10,512.8	-42.7%
Sack	2,954.7	11,045.9	+273.8%
Total	21,295.9	21,558.7	+1.2%

Table 3.2 2012 square meter predator/mortality results for the Barataria Basin (CSA 3).

Station	No.	Hooked Mussels/m^2	Oyster Drills Present	Spat Percent Mortality	Seed Percent Mortality	Sack Percent Mortality	Seed & Sack Percent Mortality	All Size Percent Mortality
Hackberry Bay 2004 North Cultch Plant	6	4.4	0	8.9	0	0	0	7
Hackberry Bay 2004 South Cultch Plant	7	31.2	0	3.3	2	0	1.4	2.1
Hackberry Bay 2008 Cultch Plant	9	14	0	1.3	8.9	0	4.9	2.6
Hackberry Bay 2012 Cultch Plant	10	0	0	2.3	0	na	0	2.2
Lower Hackberry Bay	1	1.4	0.0	25.0	100.0	0.0	66.7	42.9
Middle Hackberry Bay	2	15.0	0.0	2.8	6.9	0.0	4.5	3.2
Upper Hackberry Bay	3	1.4	0.0	76.9	50.0	0.0	40.0	60.9
Barataria Bay 2004 Cultch Plant	8	0	5.0	na	na	na	na	na
Little Lake		Unknown						

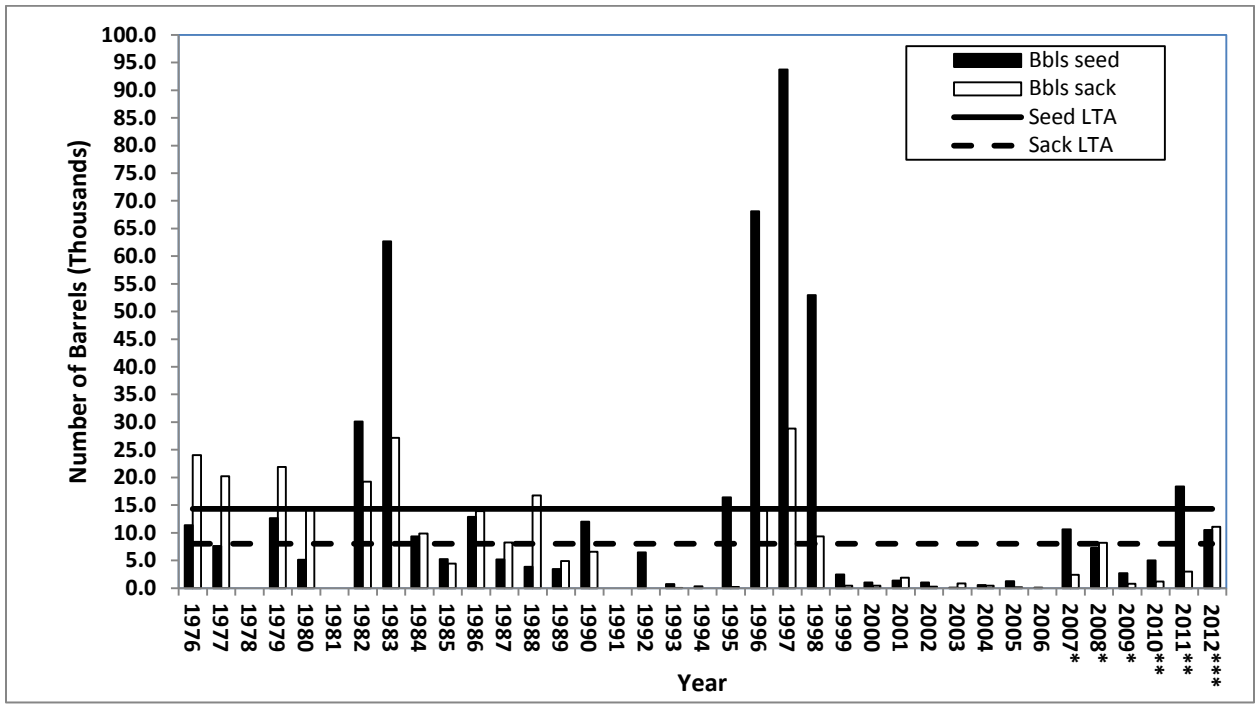

Figure 3.2 Estimated seed and sack oyster availability in the Hackberry Bay Public Oyster Seed Reservation from 1976 to 2012. * includes the 2004 cultch plants **includes the 2008 cultch plant ***includes the 2012 cultch plant.

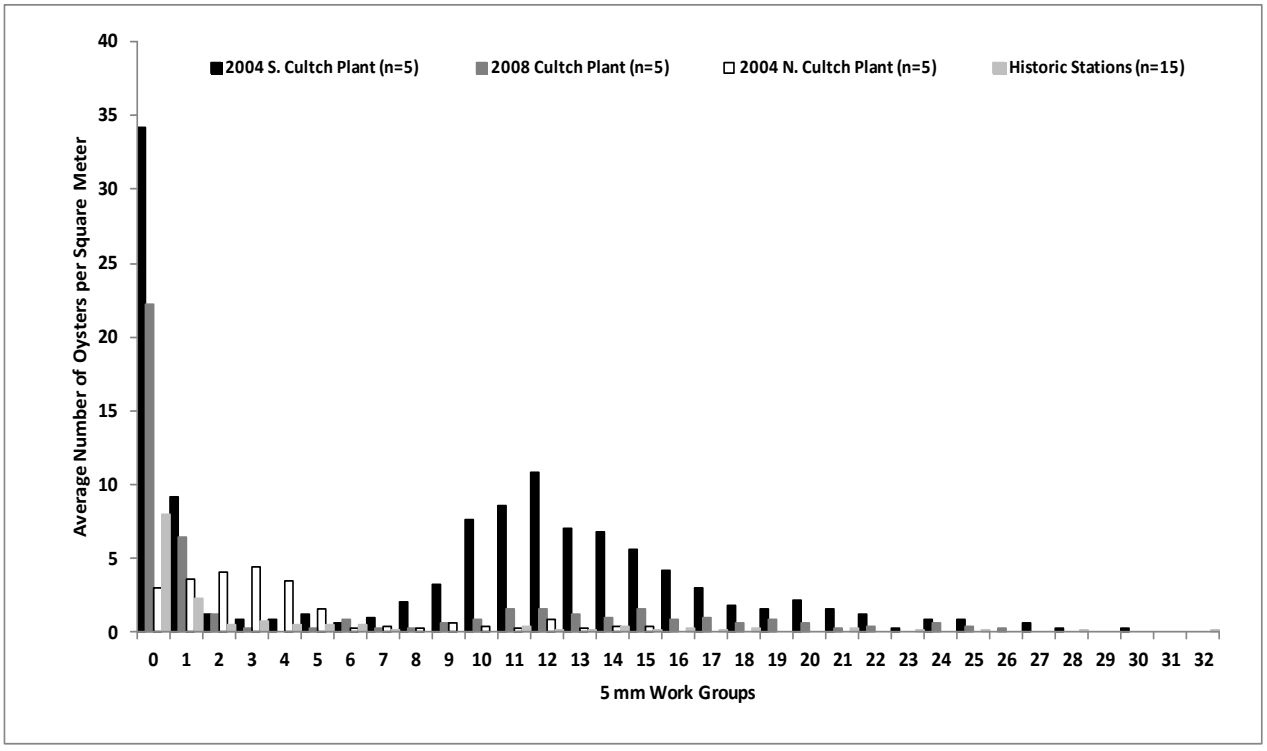

Figure 3.3 Oyster size distribution by 5 mm work groups in square meter samples collected from the Hackberry Bay Public Oyster Seed Reservation during 2012.

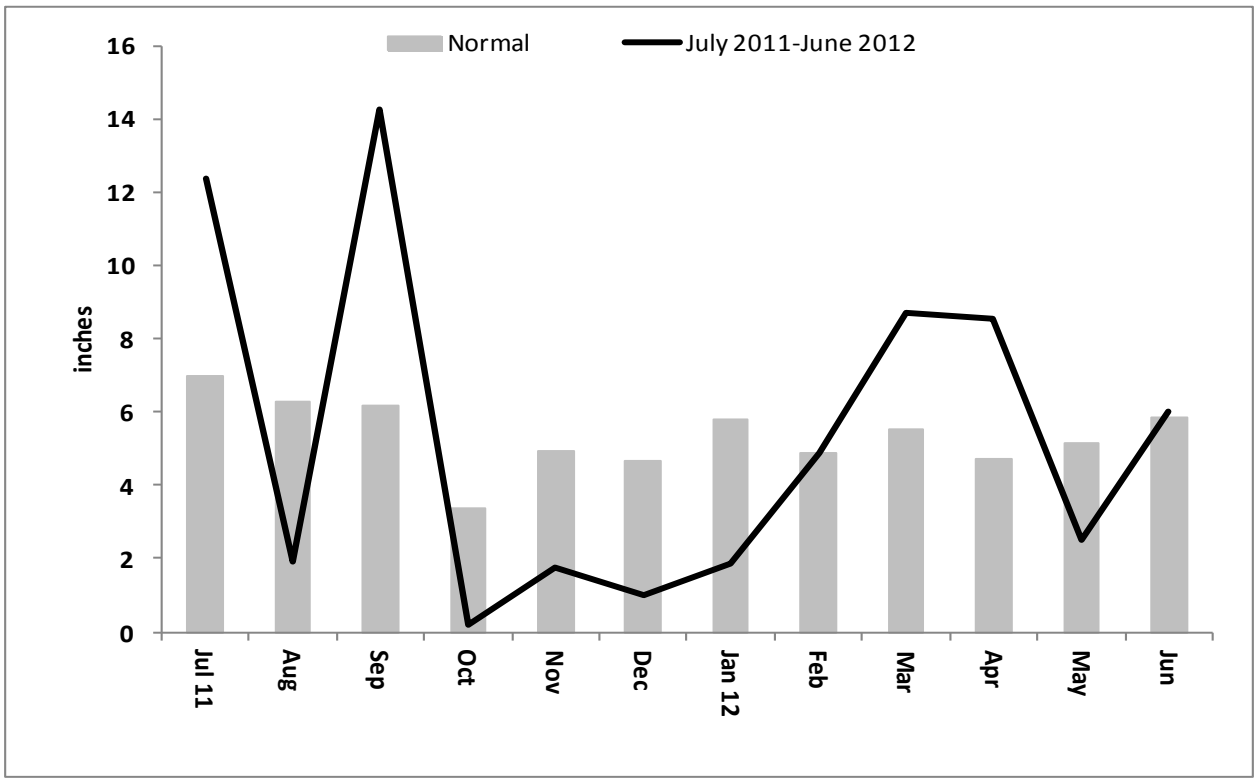

Figure 3.6 Southeast Louisiana monthly rainfall. Data supplied by Southern Regional Climate Center.

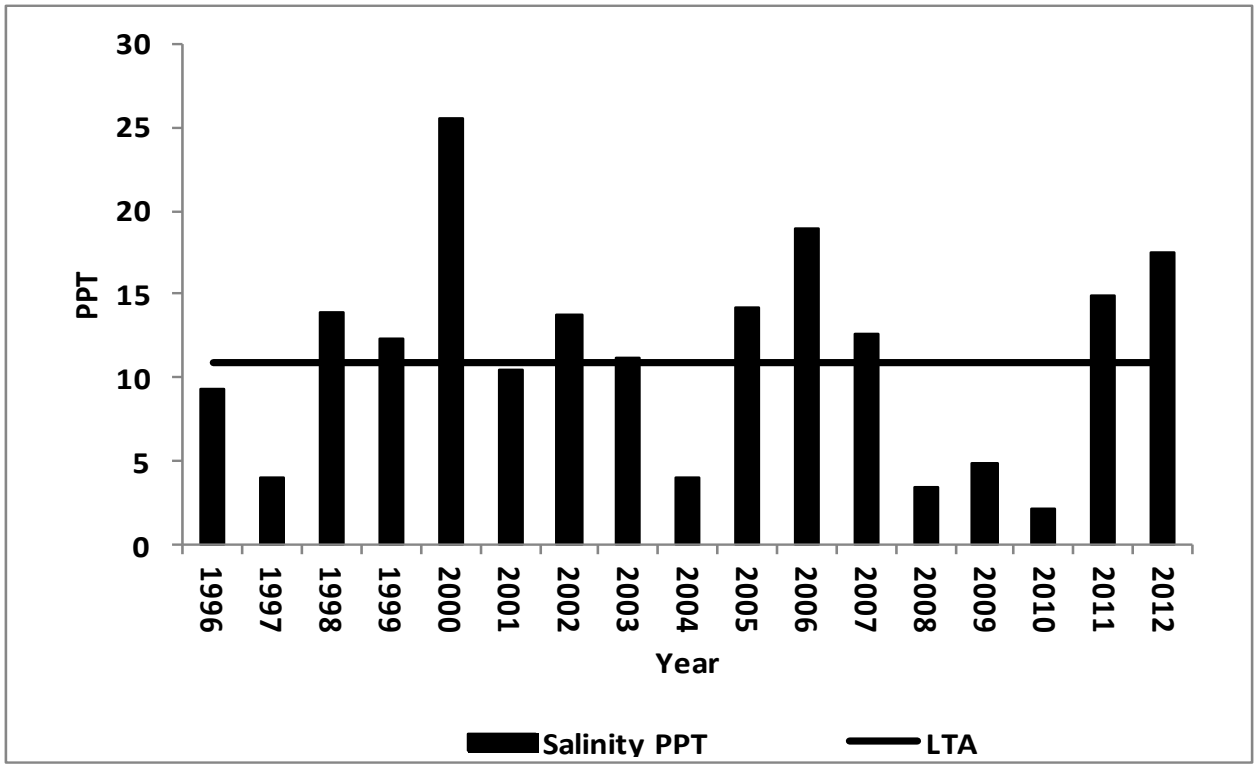

Figure 3.7 Historical average daily June salinity in ppt in Hackberry Bay from 1996-2011. Data supplied by the United States Geological Survey (USGS) constant data recorder located in Hackberry Bay.

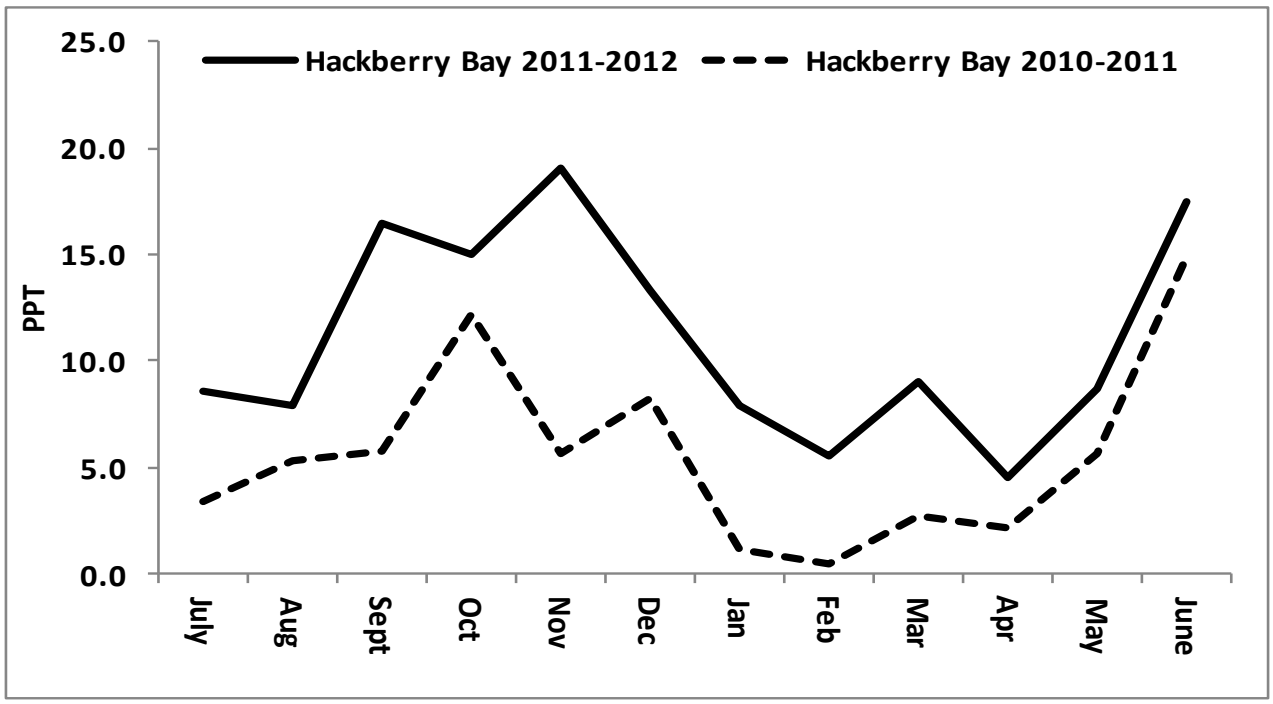

Figure 3.8 Average monthly salinities in the Hackberry Bay POSR from July 2011 through June 2012. Data from United States Geological Survey (USGS) constant data recorders located in the Hackberry Bay POSR.

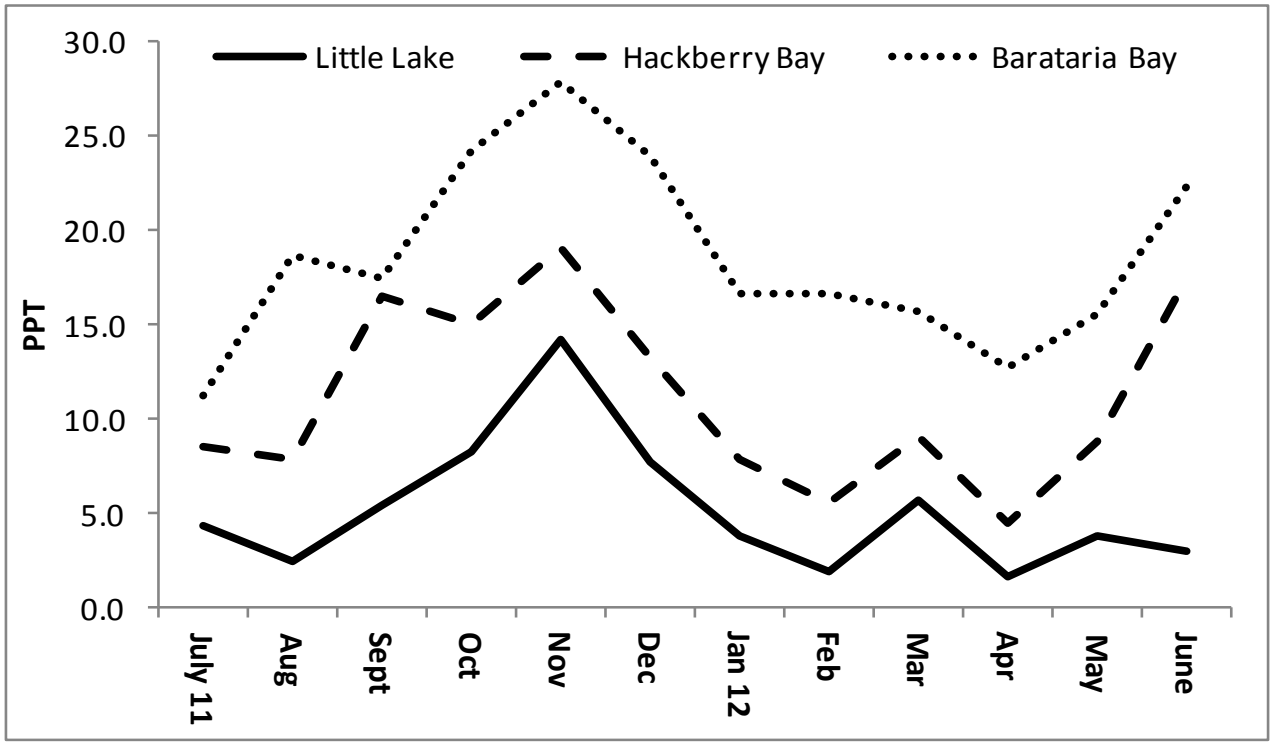

Figure 3.9 Average monthly salinities in the Barataria Bay POSG, Little Lake POSG and Hackberry Bay POSR from July 2011 through June 2012. Data from United States Geological Survey (USGS) constant data recorders located in the Barataria Bay POSG, Little Lake POSG and Hackberry Bay POSR.

Table 3.3 Estimates of oyster harvest from the public oyster areas in Coastal Study Area 3 for the past six harvest seasons.

Public Oyster Area	Seed Oysters Harvested (BBLS)	Sack Oysters Harvested (Sacks)
Hackberry Bay POSG	1,634	29
Little Lake POSG	25	0
Barataria Bay POSG	0	0
2011/2012 CSA 3 Totals	***1,659***	***29***
2010/2011 CSA 3 Totals	***0***	***0***
2009/2010 CSA 3 Totals	***7,885***	***504***
2008/2009 CSA 3 Totals	***1,985***	***3,270***
2007/2008 CSA 3 Totals	***13,930***	***976***
2006/2007 CSA 3 Totals	***12,190***	***6,091***

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Coastal Study Area (CSA) 5 – 2012 Oyster Stock Assessment

Introduction

The Terrebonne Basin (TB) includes Coastal Study Areas (CSA) 4 -- from Bayou Lafourche west to Bayou Sale, including Terrebonne Bay and Timbalier Bay -- and CSA 5 – Bayou Sale west to Atchafalaya Bay, including Sister Lake, Lake Mechant, and Caillou Bay. Separate oyster stock assessment reports were completed for each area until the two CSAs were merged in 2010 and renamed as CSA 5.

There are currently eight different Public Oyster Seed Reservations (POSR) or Public Oyster Seed Grounds (POSG) within the Terrebonne Basin; these include Sister Lake (Caillou Lake) POSR, Bay Junop POSR, Lake Mechant POSG, Deep Lake POSG, Lake Felicity POSG, Lake Chein POSG, and Lake Tamour POSG. Sister Lake, Bay Junop, and Lake Mechant are located in the western TB while Deep Lake, Lake Felicity, Lake Chien, and Lake Tambour are found in the eastern TB (Figures 5.1 and 5.2).

Sister Lake (Caillou Lake) (Figure 5.1) was designated as a POSR in 1940 and includes 9,150.5 acres of water bottoms. The first known cultch deposition projects were established here between 1906 and 1909 by the U.S. Bureau of Fisheries. Subsequent plantings by the State of Louisiana began in Sister Lake in 1917; since then 21 cultch plants totaling 4,862.5 acres have been constructed with some cultch plants being located on top of previous ones or on top of existing reef habitat. Recent Sister Lake cultch deposition projects included a 67- acre site in 2004, a 156- acre site in 2009, and a 358-acre site in 2012. Side scan sonar information from Sister Lake estimates current total reef acreage of 2,279 acres.

The Bay Junop POSR (Figure 5.1) was established in 1948 and consists of approximately 2,646.5 acres of water bottoms. Due to the shallow water depth of the bay and inability of barges and tugs to enter for cultch deposition, no reef-building projects have been implemented in this area to augment natural oyster reef production. Available public reef acreage in this bay is estimated at approximately 252 acres.

The Lake Mechant POSG (Figure 5.1) was designated in 2001 with approximately 2,100 acres of water bottoms. In 2004, a 30 acre cultch plant was established. In 2007, unleased water bottoms between the POSG and private oyster leases were added. Total acreage within the public oyster seed ground is 2,583 acres.

The Lake Tambour, Lake Chien, Lake Felicity, and Deep Lake POSGs (Figure 5.2) were established in 2001. The upper portion of Lake Felicity was used as a public seed reservation during the 1940s and early 1950s, but was discontinued because salinities were usually too high for oyster production. However, future planned coastal freshwater diversion projects may return the area to a more favorable salinity regime for oyster production.

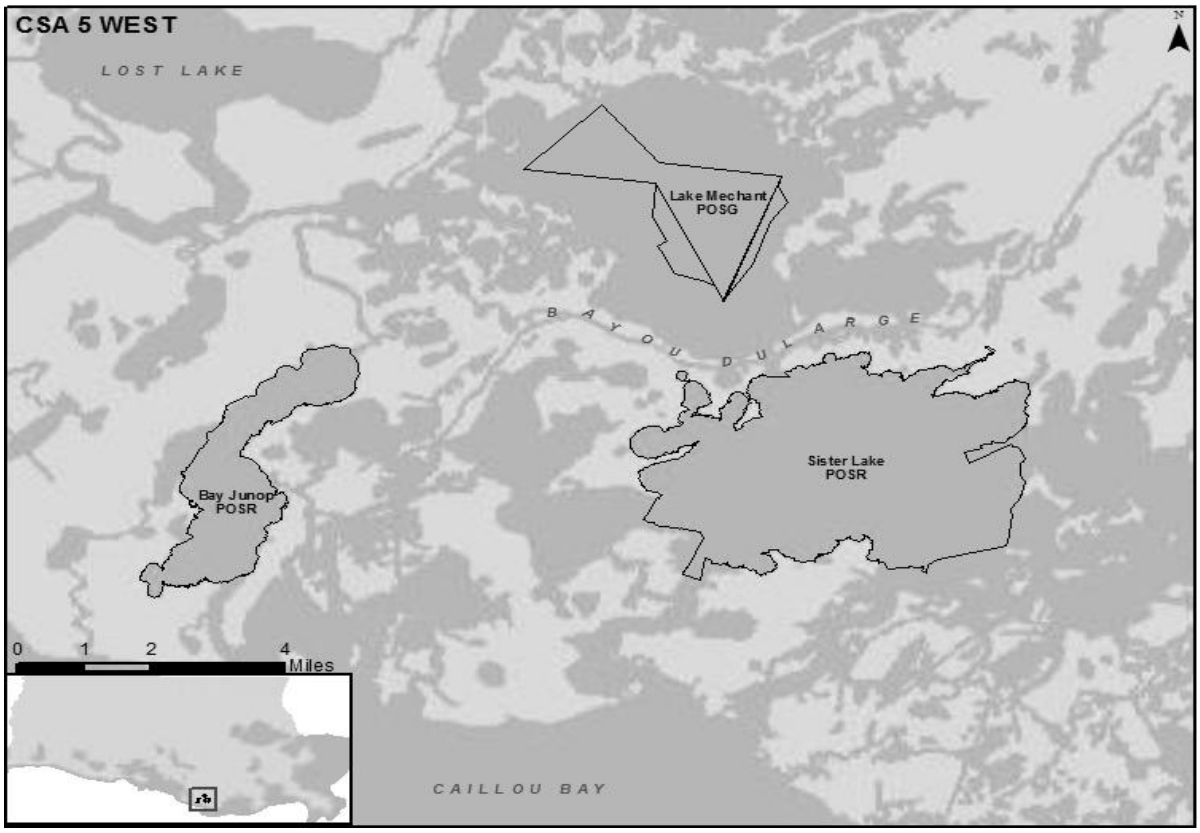

Figure 5.1. Public oyster areas within the western portion of Coastal Study Area (CSA) 5.

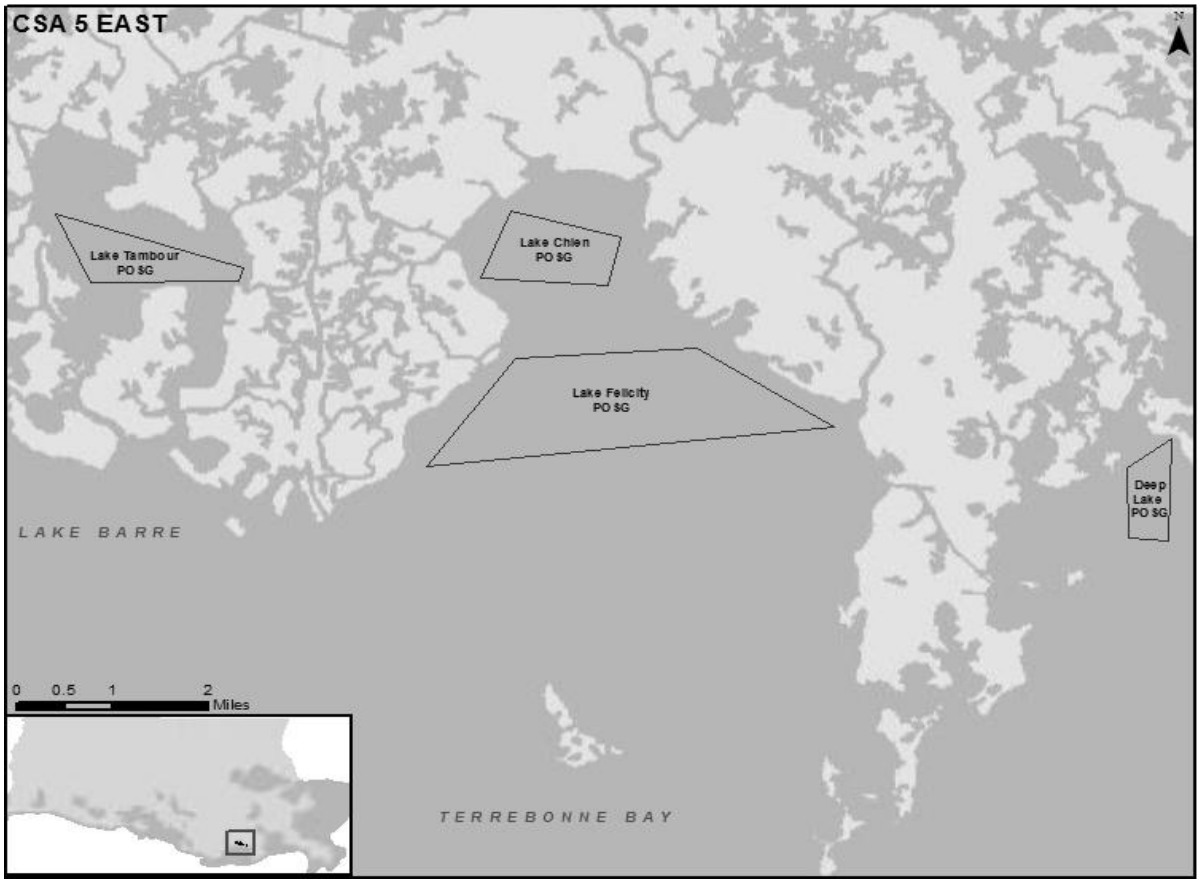

Figure 5.2. Public oyster areas within the eastern portion of Coastal Study Area (CSA) 5.

Table 5.6. Overall percent mortalities of seed and sack oysters in 2012 versus long-term means by seed ground or reservation (TB=Terrebonne Basin).

Region	Area	2012		Long Term	
		Seed	Sack	Seed	Sack
Western TB	Sister Lake	1.1	0	0.7	0
	Bay Junop	12	0	6.3	4.7
	Lake Mechant	1.6	--	1.8	0
Eastern TB	Lake Felicity	2	0	18.6	0
	Lake Chien	2.2	0	5.8	0.7

Table 5.7. Average numbers of hooked mussels and mud crabs per sample by seed ground or reservation and overall (TB=Terrebonne Basin).

Region	Seed Ground	Numbers Per Sample				
		Hooked Mussels	Mud Crab	Oyster Drill	Stone Crab	Blue Crab
Western TB	Sister Lake	5.3	2.6	0.02	0	0
	Bay Junop	2.8	5.7	0.05	0.05	0
	Lake Mechant	83.2	1.4	0	0	0.2
	Overall	9.6	3.3	0.02	0.01	0.01
Eastern TB	Lake Felicity	0	1.4	0	0	0
	Lake Chien	0.2	1.3	0	0	0
	Overall	0.1	1.3	0	0	0

Lake Chien and Lake Felicity POSGs together have three cultch plants. Cultch deposition projects in Lake Chien (15.5 acres) and Lake Felicity (40 acres) were completed in the summer of 2004. Another 22.3 acre cultch plant was created in Lake Chien in May 2009 due east of the initial Lake Chien cultch plant. Outside of these cultch plants, there is no known reef in these areas and no reef development projects have been implemented in Lake Tambour or Deep Lake.

Materials and Methods

Square-meter field samples were collected on July 5-6, 2012 on existing oyster reefs in Sister Lake, Bay Junop, Lake Mechant, Lake Felicity, and Lake Chien (Figures 5.3-5.5).

SCUBA divers collected five replicate samples at each station using an aluminum square meter frame that was tossed randomly over the reef. All oysters, loose shell and other organisms were removed from the upper portion of the substrate. Live and dead oysters, oyster predators, and hooked mussels (*Ischadium recurvum*) were separated and counted. Oysters were measured in 5 millimeter (mm) size groups and subsequently divided into three categories: spat (<25 mm), seed (25-74 mm), and sack (75 mm and larger) oysters. In conjunction with square meter oyster samples, water temperature and salinity data were also collected.

The average number of seed and sack oysters per square meter sample at each station was used to estimate oyster stock availability by extrapolation using known reef acreage.

Results and Discussion

Resource Availability

The overall 2012 estimated resource availabilities in the Terrebonne Basin POSGs and POSRs are 46,609.3 barrels of seed oysters and 45,659 barrels of sack oysters in the western basin (Sister Lake, Bay Junop, and Lake Mechant) and 3,810.7 barrels of seed oysters and 1,148.9 barrels of sack oysters in the eastern basin (Lake Felicity and Lake Chien) (Tables 5.1 – 5.3).
With one exception all estimates of seed and sack oyster resource availability in 2012 were below long-term historic means (Figures 5.6 - 5.10). In Sister Lake, the most productive oyster area in the Terrebonne Basin, estimated 2012 seed and sack oyster availabilities declined 73% and 64%, respectively, from long-term means. Lake Chien showed the sole increase in 2012 resource availability. Overall Terrebonne Basin estimated seed and sack oyster availabilities were 74% and 69% below their long long-term means, respectively.

Spat Production

Numbers of spat averaged 15.3/sample in the eastern basin and 5.7/sample in the western basin, and were below the long-term means.

Hydrological Data

Mean water temperatures on each public oyster area ranged from 29.0-29.3 ^{o}C and were slightly above the long-term means. Mean salinities were above average in the western TB and slightly below average in the eastern TB (Tables 5.4 and 5.5).

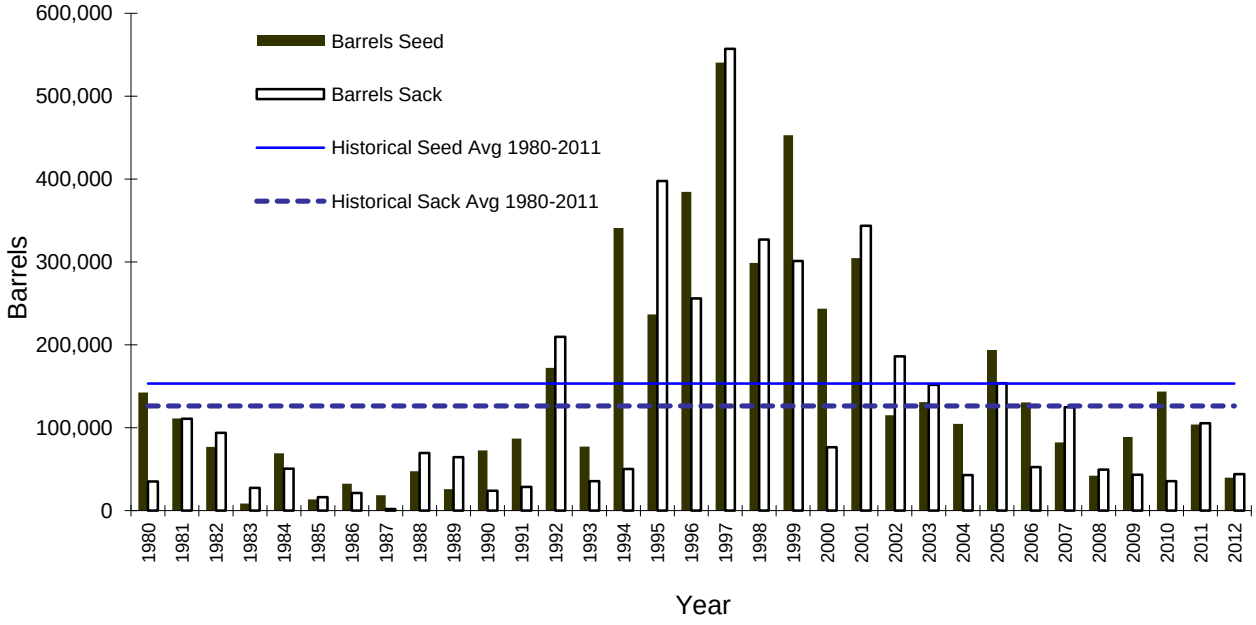

Figure 5.6. Historical oyster stock availability in Sister Lake.

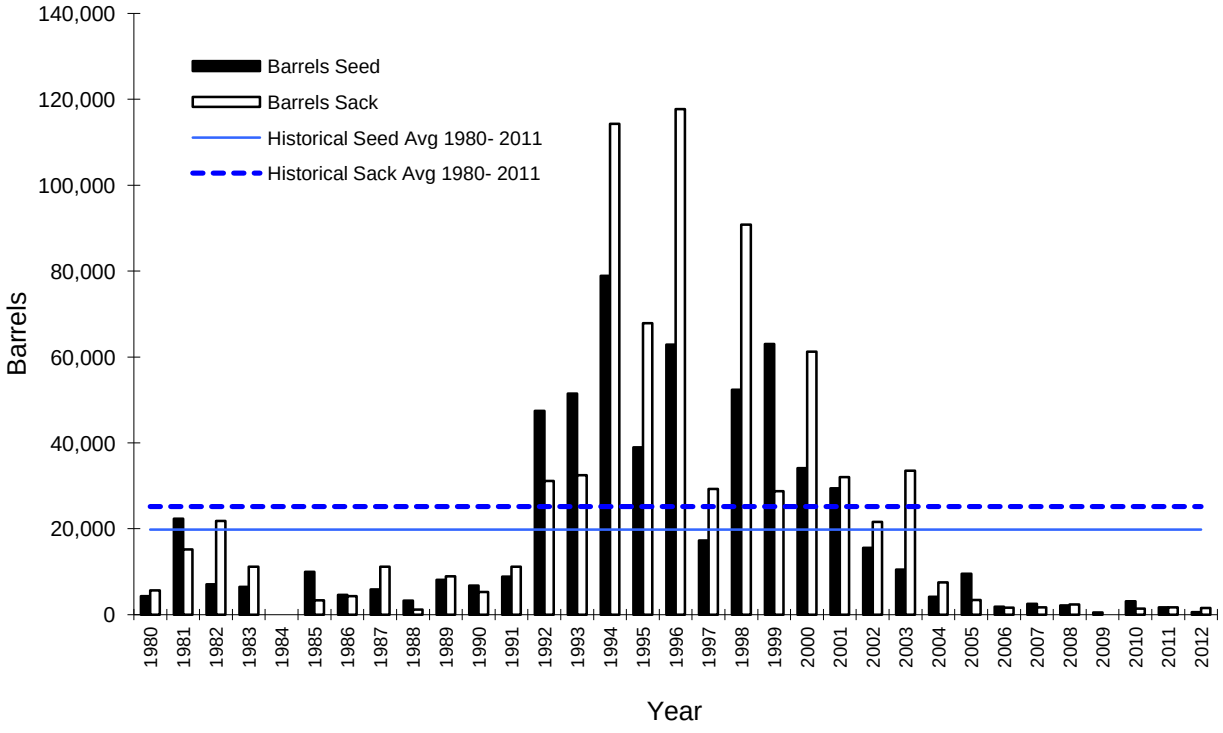

Figure 5.7. Historical oyster stock availability in Bay Junop.

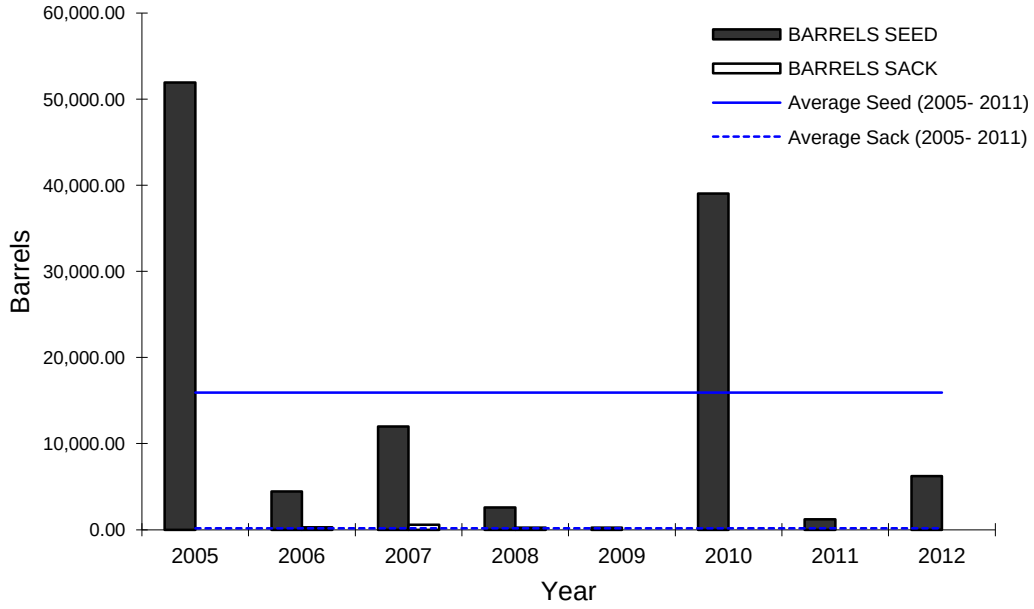

Figure 5.8. Lake Mechant historic oyster availability

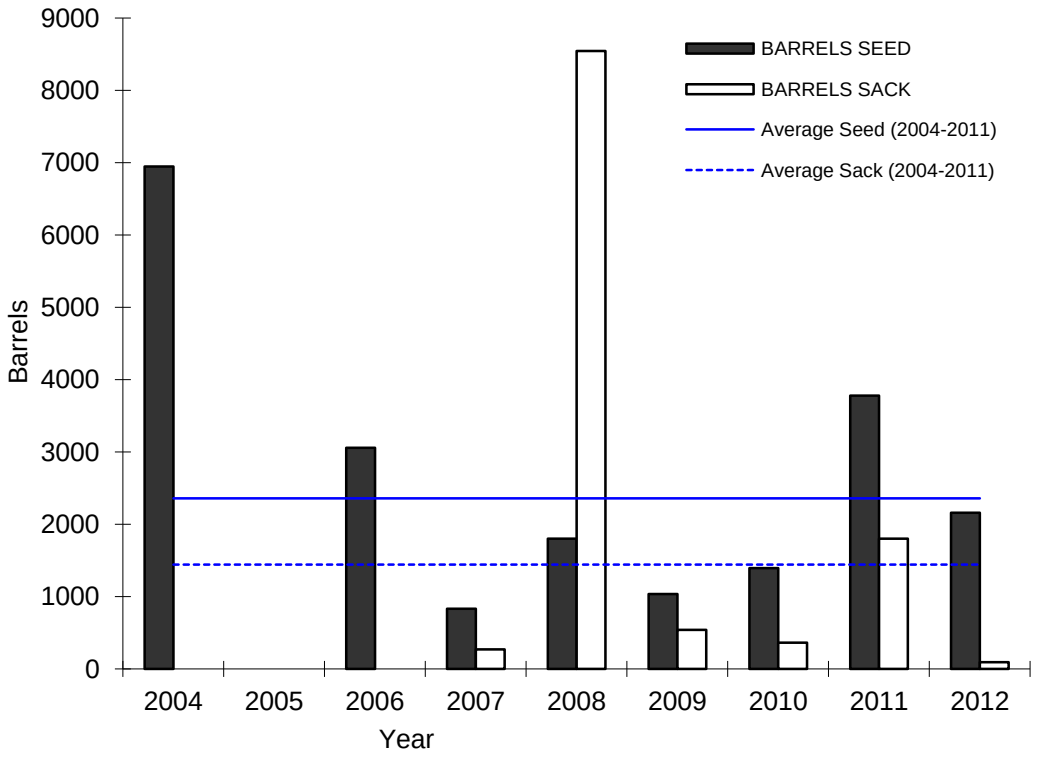

Figure 5.9. Lake Felicity historic oyster availability

Mortality
No recent mortalities of sack oysters were observed in 2012 square meter samples in the Terrebonne Basin (Table 5.6). Mortalities of seed oysters in Sister Lake and Bay Junop were above long-term means while all remaining oyster areas had below average seed oyster mortalities.

Fouling Organisms / Predators / Disease
Five incidental species (hooked mussels, mud crab, oyster drill, stone crab, and blue crab) were collected in square meter samples (Table 5.7). Hooked mussels were abundant in Lake Mechant (83.2/sample) and Sister Lake (5.3/sample). The only other common species was the mud crab.

Dermo (*Perkinsus marinus*) may cause extensive oyster mortalities in conditions of high salinities and water temperatures. Oysters from the Terrebonne Basin public oyster areas were analyzed for the presence of Dermo by the University of New Orleans, and will be presented in a separate section.

Deepwater Horizon Oil Spill and Related Response Actions
The BP Deepwater Horizon oil spill released millions of barrels of oil into the Gulf of Mexico affecting the Louisiana coastline, including oyster resources. The impacts of oil on oysters resources continue to be of concern. Assessment continues on the direct and indirect impacts of oil and response actions to Louisiana's near shore environment, including to oysters and oyster habitat.

Tropical Weather / Flooding Events
Tropical Storm Debby off the Louisiana coast during the last week of June produced above average tides in the Terrebonne Basin. No observed impacts on oyster populations were noted.

<u>2011/2012 Oyster Season Summary</u>
Oyster harvests on the POSGs and POSRs were monitored through boarding reports and trip ticket records. These data were used to calculate annual estimates for each public oyster area (Tables 5.8 and 5.9).

Sister Lake: Sister Lake was open from October 31 to December 15, 2011. The total fishing effort of 1,327 vessel-days included 1,266 vessel-days for market oysters and 61vessel-days for seed oysters. Total estimated harvest was 86,812 sacks of market oysters (88% greater than the 1995-2010 mean) and 15,765 barrels of seed oysters (14% less than 1995-2010 mean).

Lake Mechant: Lake Mechant opened on October 31, 2011 and was closed April 30, 2012 by the LDWF, although the Department of Health and Hospitals (DHH) implemented a seasonal public health closure on November 1, 2011. No fishing effort was documented in Lake Mechant.

Bay Junop: Bay Junop was open from October 31 to December 15, 2011. Fishing effort was very low because of a DHH seasonal public health closure which excluded the majority of the POSR to oyster harvest. Only two vessel-days of fishing effort and 100 sacks of market oysters were estimated to have been harvested.

Lake Chien / Lake Felicity: Lake Chien and Lake Felicity were open from October 31 to November 4, 2011. Fifty vessel-days of effort yielding 2,458 sacks of market oysters and 156 barrels of seed oysters were estimated to have been harvested from Lake Chien; of this total, 16 vessel-days of effort and 677 sacks of market oysters and 20 barrels of seed oysters were documented from the 2009 cultch plant. Harvest activity in Lake Felicity included 20 vessel-days of effort producing an estimated 351 sacks of market oysters and 671 barrels of seed oysters.

Compared to the 2005-2010 means, 2011 harvests in Lake Felicity and Lake Chien varied differently. In Lake Felicity, the harvests of market oysters was 61% below and seed oyster harvest was 248% above long-term means, while Lake Chien harvests of market and seed oysters was 177% above and 80% below long-term means, respectively.

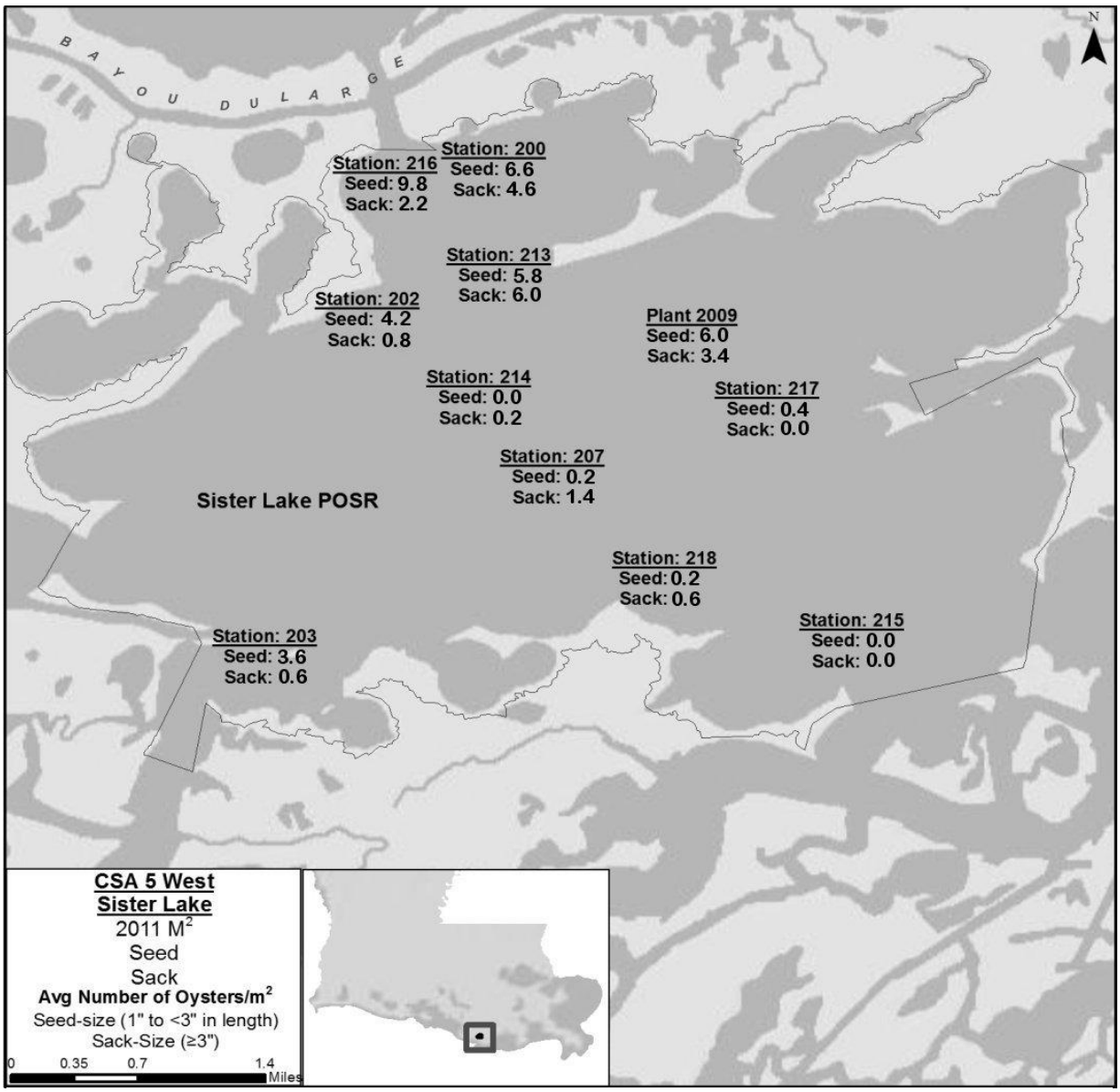

Figure 5.3. Results from each square-meter sampling station within Sister Lake.

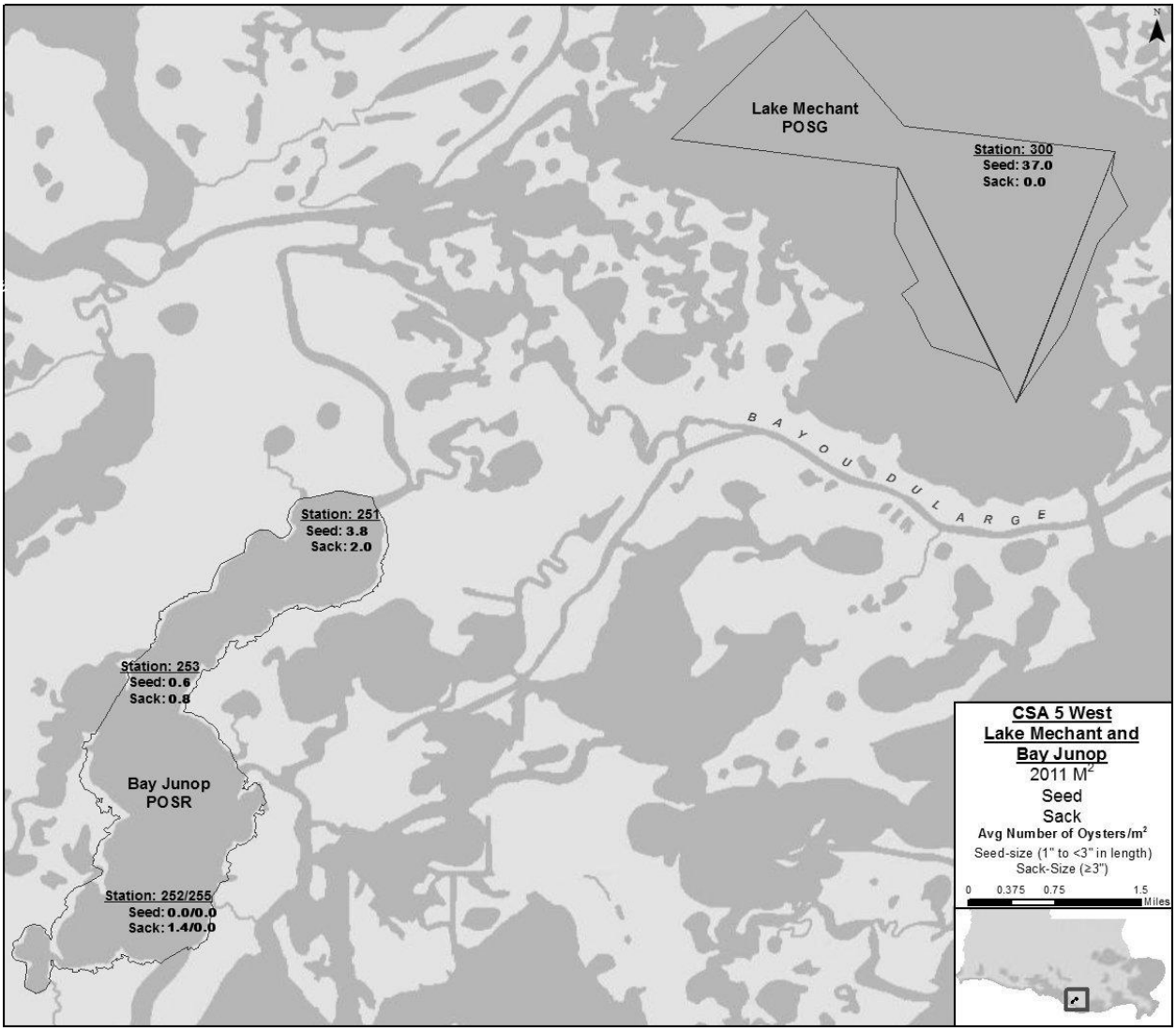

Figure 5.4. Results from square-meter sampling stations within Bay Junop and Lake Mechant.

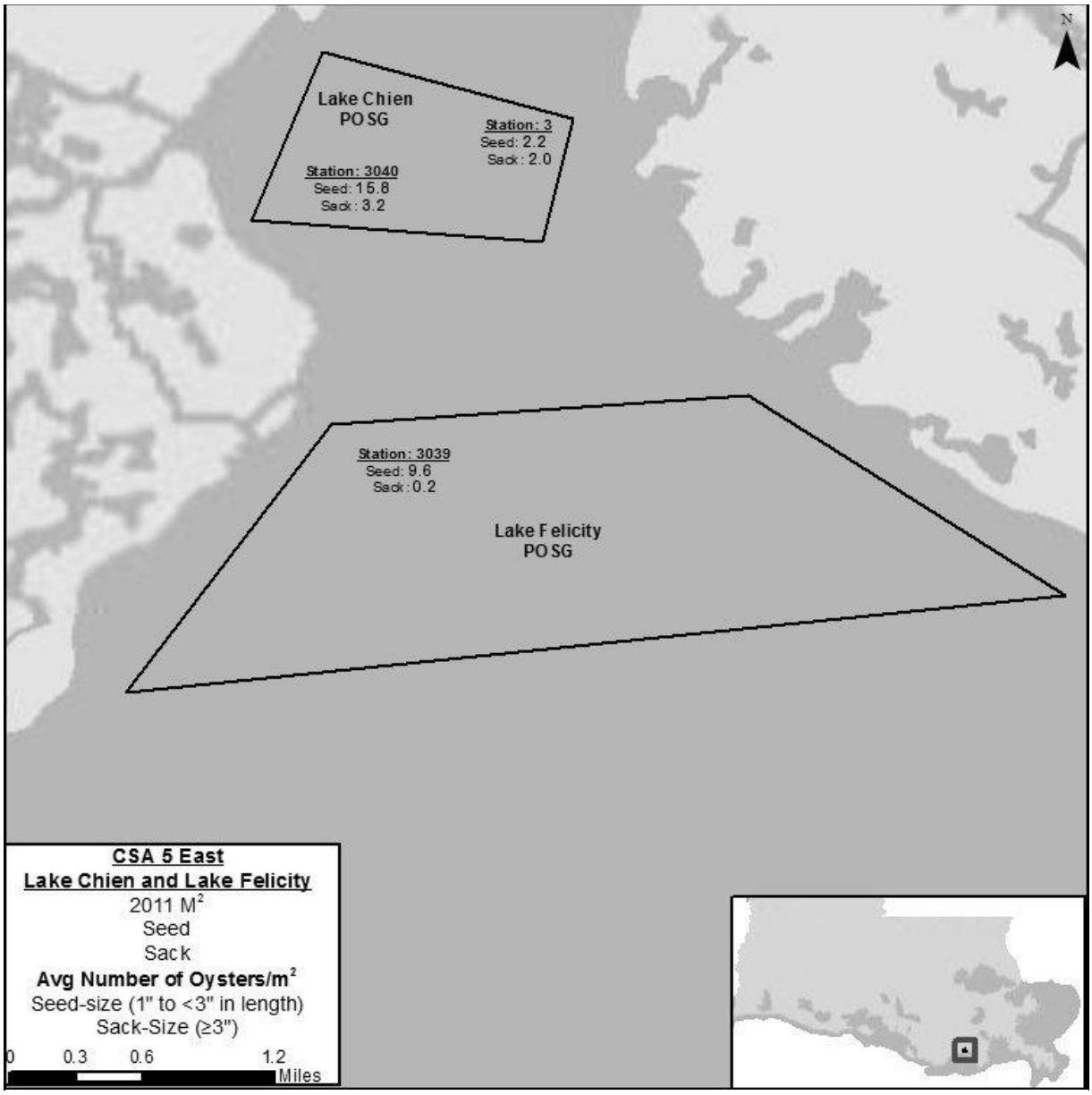

Figure 5.5. Results from square-meter sampling stations within Lake Chien and Lake Felicity.

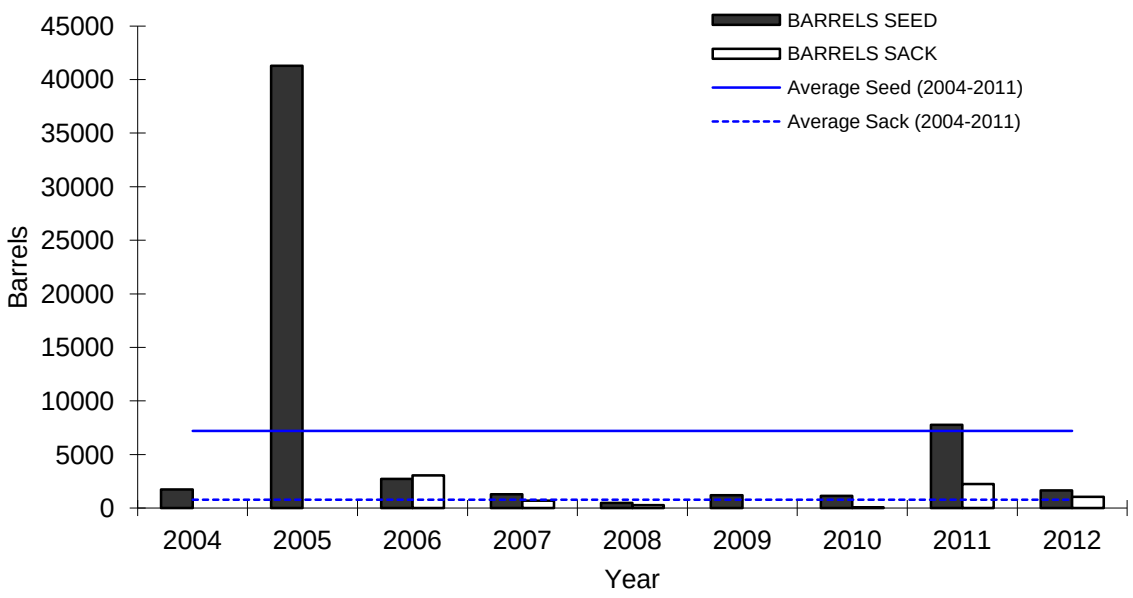

Figure 5.10. Lake Chien historic availability

Table 5.1. 2012 Sister Lake oyster availability by sample station.

METER² STATION	REEF ACREAGE*	#METER²	#SEED OYSTERS	#SACK OYSTERS	BARRELS SEED OYSTERS	BARRELS SACK OYSTERS
200	322.4	1304707.4	6.6	4.6	11,960.19	16,671.78
202	119.21	482,420.24	4.2	0.8	2,814.21	1,072.08
203	220.16	890,943.57	3.6	0.6	4,454.86	1,484.95
207	270.22	1,093,556.54	0.2	1.4	303.78	4,252.85
213	139.68	565,267.22	5.8	6	4,553.68	9,421.42
214	187.7	759,577.83	0	0.2	0	422
215	117.86	476,944.22	0	0	0	0
216	167.33	677,143.02	9.8	2.2	9,216.96	4,138.23
217	481.29	1,947,719.51	0.4	0	1,081.45	0
218	97.49	394,509.41	0.2	0.6	109.59	657.54
219	156	631,312.19	6	3.4	5,261.10	5,962.58
TOTAL	2,279.34*	8,592,788.98	36.8	19.8	39,755.81	44,083.43

*2005 Side Scan Sonar Survey conducted May 2005 measure Sister Lake acreage to be 2,279 acres of reef. This is an increase of 45.5% over prior years' estimates. Starting in 2007, individual site acreage has been adjusted accordingly to reflect this increase of availability. The 2012 SL cultch plant (358 acres) is not included in these totals. Although the new cultch plant was sampled during the 2012 stock assessment, no seed or sack oysters were collected.

Table 5.2. 2012 Bay Junop Oyster Availability

METER² STATION	REEF ACREAGE	#METER²	#SEED OYSTERS	#SACK OYSTERS	BARRELS SEED OYSTERS	BARRELS SACK OYSTERS
251	17.2	69,606.22	3.8	2	367.38	386.71
252/255	67.36	272,597.37	0	0.7	0	530.07
253	73.26	296,473.92	0.6	0.8	247.07	658.85
TOTAL	157.82	638,677.51	4.4	3.5	614.45	1,575.63

Table 5.3. 2012 Lake Mechant/Lake Chien/Lake Felicity Oyster Availability

METER² STATION	REEF ACREAGE	#METER²	#SEED OYSTERS	#SACK OYSTERS	BARRELS SEED OYSTERS	BARRELS SACK OYSTERS
Lake Mechant	30	121,406.19	37	0	6,239.13	0
Lake Felicity	40	161,874.92	9.6	0.2	2,158.4	89.9
Lake Chein 2009	22.3	90,245.27	2.2	2	275.8	501.4
Lake Chein 2004	15.5	62,726.53	15.8	3.2	1,376.5	557.6
TOTAL	107.8	436,252.91	64.6	5.4	10,049.83	1,148.9

Table 5.4. Mean May-June and historic means (excluding 2012) of water temperature (°C) and salinity (ppt) from Sister Lake, Bay Junop, and Lake Mechant dredge samples (X= not designated as seed ground or reservation).

YEAR	TEMPERATURE			SALINITY		
	Sister Lake	Bay Junop	Lake Mechant	Sister Lake	Bay Junop	Lake Mechant
1995	28.2	29.3	X	11.7	18.0	X
1996	28.4	29.4	X	11.6	18.3	X
1997	28.6	27.5	X	3.4	10.7	X
1998	29.0	28.5	X	5.7	11.5	X
1999	26.9	26.9	X	15.1	16.2	X
2000	28.1	29.0	X	20.3	26.6	X
2001	27.1	28.1	X	12.9	14.1	X
2002	28.6	28.5	26.9	12.7	16.3	2.8
2003	28.9	28.9	28.4	11.3	13.6	5.0
2004	28.7	28.4	27.8	14.7	18.8	3.8
2005	28.3	28.2	27.5	16.2	18.5	4.7
2006	28.9	28.3	28.4	17.7	18.4	10.5
2007	27.6	27.5	29.2	19.4	20.0	11.5
2008	28.1	27.9	28.1	6.4	5.7	0.5
2009	29.5	29.2	28.9	10.4	12.1	2.7
2010	28.7	28.1	30.2	17.9	15.5	5.7
2011	26.5	26.6	25.7	15.3	15.6	5.4
2012	29.3	29.3	29.0	16.5	17.7	9.4
Mean	28.3	28.3	28.2	13.3	16.0	5.6

Table 5.5. Mean May-June and historic means (excluding 2012) of water temperature (°C) and salinity (ppt) from Lake Felicity and Lake Chein dredge samples.

YEAR	TEMPERATURE		SALINITY	
	Felicity	Chein	Felicity	Chein
2006	27.6	27.8	24.9	25.0
2007	27.4	27.6	20.9	20.7
2008	28.2	28.6	16.0	16.0
2009	28.3	28.6	21.3	21.1
2010	29.2	29.5	18.6	17.8
2011	27.2	27.5	25.0	24.9
2012	29.0	29.0	20.0	19.2
Mean	28.1	28.4	21.0	20.7

Table 5.8. Annual totals and long-term means of commercial seed oyster (barrels) and sack oyster (sacks) harvests from Sister Lake, Lake Mechant, and Bay Junop (NS=no season; X=not designated as seed ground or reservation).

YEAR	SISTER LAKE		BAY JUNOP		LAKE MECHANT	
	Seed	Sack	Seed	Sack	Seed	Sack
1995	51,160	48,824	NS	NS	X	X
1996	20,055	40,019	3,770	26,908	X	X
1997	31,668	43,727	NS	NS	X	X
1998	15,228	16,510	6,205	20,345	X	X
1999	29,934	47,586	NS	NS	X	X
2000	NS	NS	NS	NS	X	X
2001	18,183	34,060	NS	NS	X	X
2002	NS	NS	40	1,031	X	X
2003	11,840	92,580	NS	NS	X	X
2004	NS	NS	5	2,623	0	2,211
2005	3,200	81,788	NS	NS	NS	NS
2006	NS	NS	10	3,890	NS	NS
2007	16,960	42,514	NS	NS	19,665	132,703
2008	600	5,530	0	737	NS	NS
2009	4,610	13,676	NS	NS	NS	NS
2010	NS	NS	0	433	0	91
2011	15,765	86,812	0	100	0	0
MEAN	18,267	46,136	1,254	7,008	4,916	33,751

Table 5.9. Annual totals and long term means of seed oyster (barrels) and sack oyster (sacks) harvests from Lake Felicity and Lake Chein cultch plants (NS=no season; X=not designated as seed ground or reservation).

YEAR	LAKE FELICITY		LAKE CHIEN TOTAL	
	Seed	Sack	Seed	Sack
2005	15	0	253	0
2006	0	0	1,940	0
2007	470	4,830	2,157	2,439
2008	0	0	205	17
2009	NS	NS	NS	NS
2010	0	205	0	405
2011	671	351	156	2,458
MEAN	193	898	785	887

Coastal Study Area (CSA) 6 – 2012 Oyster Stock Assessment

Introduction

Oyster reefs found in the Vermilion/East and West Cote Blanche/Atchafalaya Public Oyster Seed Ground generally fall within the boundaries of Coastal Study Area 6 (CSA6). The inside oyster seed ground, promulgated by the Louisiana Wildlife and Fisheries Commission in 1990, consists of that portion of state water bottoms found generally north of a line from the western shore of Vermilion Bay and Southwest Pass eastward to Point Au Fer. The outside area, designated in 1988, consists of Louisiana State Territorial Waters from the private oyster lease boundary near Mound Point/Marsh Island eastward to Point Au Fer. Since 1986 (prior to the official designation of these areas as seed grounds), Louisiana Department of Wildlife and Fisheries (LDWF) managed the oyster resources found on local state water bottoms in a manner similar to present seed ground management procedures. This allowed limited harvest/relays from the Vermilion Bay area reefs when hydrological conditions and oyster abundance and distribution permitted.

The Vermilion/Cote Blanche/Atchafalaya Bays Complex is a large, primarily open-water brackish system with the area seed grounds consisting of approximately 541,787 water bottom acres. Primary influences on the bays' dynamic salinity regime are the Gulf of Mexico, Atchafalaya River and the adjacent Wax Lake Outlet, and the Vermilion River. In general, the public oyster seed grounds within CSA 6 are highly influenced by freshwater discharge from the Atchafalaya River. Typically, oyster reproduction occurs in the fall after the river stage abates, with oysters growing to seed size (1 inch to < 3 inches) by the following spring. However, spring and early summer floodwaters depress salinities, placing extreme physiological stress on the organisms. These low salinities, coupled with high water temperatures through the summer months, typically result in extensive oyster mortalities on the public grounds. Occasionally, however, reduced freshwater inflow from the Atchafalaya River leads to higher-than-normal salinities and the normal annual cycle of extensive oyster mortalities is broken, leading to a harvestable population of seed oysters during the following oyster season (September through April). Such was the case in 2000, 2001, 2005, 2006, and 2007 when sizeable quantities of seed oysters were available for harvest.

A quantitative Vermilion Bay area stock assessment, including total oyster stock size, is not possible at this time, as figures relative to oyster reef sizes are not available. However, data collected from this year's sampling program are compared to previous years' data, examining hydrologic conditions, marine fouling, and oyster predators on sampled reefs. In addition, information regarding the 2011/2012 oyster season harvest on the Vermilion Bay area public oyster seed grounds is presented.

Methods

Field sampling was conducted on July 9 and 16, 2012. A total of ten stations (Figures 6.1 and 6.2) were sampled with five replicate samples collected at each station, characterizing the spatial distribution of sampling effort on the hard-bottom areas found within the system. Upon reaching the designated site, the square meter frame was randomly thrown onto the oyster reef. A

SCUBA diver removed all oysters, associated macroscopic organisms, and loose surface shell within the frame. All live oysters, and shells from recently dead oysters, were counted, measured in five millimeter (mm) intervals, then classified as spat (<25 mm), seed (25 mm to < 75mm), or sack oysters (≥75mm). Shells from recently dead oysters were defined as "box" (both valves attached) or "valve" (one valve). Oyster size was determined by measuring the "straight-line" distance from the hinge to the apex of the shell. Live predators and fouling organisms were counted. Cultch type and reef condition were noted. Water temperature and salinity data were collected in conjunction with square meter oyster samples.

Results and Discussion

Seed and Sack Stock

Live seed oysters were found at seven of the ten sampled sites, with average numbers ranging from 0.0 (at the Rabbit Island, Bayou Blanc, and Sally Shoal locations) to 10.0 at Indian Point. Similar to last year's survey, the majority of the seed-size oysters were found at sample sites in the vicinity of Southwest Pass. Live sack-sized oysters were found at the Big Charles and Indian Point sites, with replicates averaging 0.2 oysters at each site. No sack-sized oysters were found at the remaining eight sites (Figures 6.1, 6.2, and 6.3).

Spat Production

Spat was collected at seven of the ten sampled sites, with higher concentrations of spat set in the western part of the system (in the vicinity of Southwest Pass; Figures 6.1 and 6.2). With the exception of the Sally Shoal and Vermilion Bay locations (where little suitable substrate was found), viable hard bottom habitat was available for spat set.

Fouling organisms

An overall increase of more than 200% in hooked mussel *(Ischadium recurvum)* productivity on the seed ground compared to last year's assessment was documented, with an increase in numbers at all sites except Indian Point and Lighthouse Point (where a slight decrease was noted). While mussel numbers at most sample sites were somewhat higher than previous years, many of the mussels were very small in size (Table 6.1).

Oyster Predators

No evidence of the southern oyster drill *(Stramonita haemastoma)* was noted in any of the square meter samples, which is not surprising considering the depressed salinities normally found in this area. These predatory marine snails are more often associated with higher saline waters where they are known to prey heavily on oysters and other bivalve species. A slight change in mud crab *(Xanthidae sp.)* occurrence was observed compared to last year's assessment. They were present at all stations, with a slight overall decrease in numbers on the western part of the system, and a slight increase on the eastern portion. No blue crabs *(Callinectes sapidus)* or stone crabs *(Menippe adinia)* were captured in the samples.

Dermo

Dermo (*Perkinsus marinus*), a protozoan parasite prevalent in oysters, may cause extensive mortalities in conditions of high salinities and water temperatures. As in previous years, an attempt to collect samples from the eastern and western part of the system for analysis of the

presence of this pathogen was made. An oyster dredge was used to collect a sufficient number of seed and sack-oysters from the Indian Point site. Only seed was collected at the South Point site as no sack-size oysters were available. All samples were forwarded to Dr. Tom Soniat for quantification of the infestation rate of the protozoan. Results of Dermo analysis are contained within a separate section of this document.

Mortality

The oyster resource found in the area is highly vulnerable to low salinity/high turbidity conditions often seen as a result of extended freshwater conditions associated with high Atchafalaya River discharge. Independent of local rainfall, rising water levels at the Butte La Rose gauge can generally be tied to falling salinity levels in the Vermilion Bays complex. This correlation was documented for the early winter of 2011/2012 (Figure 6.5), with its effects on local oysters noted in this year's assessment.

Beginning in December 2011, a dramatic increase in Atchafalaya River flow began to push fresh and turbid water into the system. An associated decrease in both water temperature and salinity levels was documented. River flow remained well above the long term mean throughout the winter, with levels not falling below eight feet at the Butte la Rose gauge until mid April of 2012. Salinity levels measured at the Cypremort Point gauge were at 2.0 ppt or lower from February through May. Despite the low recorded salinity, little or no oyster mortality was documented in dredge samples collected during this period (possibly a result of the local oyster population's tolerance to low salinity conditions and reduced physiological stresses resulting from cool water temperatures).

As noted in the last year's assessment report, high 2011 summer-time mortalities left few live oysters available for harvest during the 2011/2012 season. Oyster dredge samples beginning in August of last year saw a relatively successful spat set in the fall, with growth of those oysters documented through June of 2012. Despite this growth, little of the resource has had appropriate time to reach market size. Recovery in the eastern part of the system has been slower than that seen in the vicinity of Southwest Pass. This cycle of recovery from a distressed resource resulting from low salinity/high water temperatures in summer to positive productivity as salinity rises and water temperatures fall in autumn is very common in this system.

Tropical and Climatic Events

No tropical storms or significant climatic events affected the Vermilion area seed grounds since the 2011 assessment.

<u>2011/2012 Oyster Season Summary</u>

Methods

Roving surveys on portions of the seed grounds with "OPEN" designation under DHH's classification system and areas under DHH relay permit are made to obtain fishery dependent data (i.e. harvest estimates). Fishermen working the seed ground are surveyed and asked to provide estimates of past and current catch rates as well as an estimate of future fishing effort. These data are summarized weekly to maintain a cumulative estimate of harvest for specific reef complexes. Trip ticket data is analyzed to provide additional harvest information.

Results & Discussion

The Vermilion/East and West Cote Blanche/Atchafalaya Bay Public Oyster Seed Grounds opened one-half hour before sunrise on October 31, 2011 and remained open until one-half hour after sunset on April 30, 2012.

An estimated 2,638 sacks were taken from the seed ground areas, with the majority harvested from reefs north of Southwest Pass in Vermilion Bay. No harvest of seed oysters was observed or reported.

Station Name	Station Code	Latitude	Longitude
Big Charles	002	29.61433	-91.98621
Indian Pt	003	29.68633	-91.90183
Vermillion Bay	004	29.62500	-92.00833
Sally Shoal	020	29.65444	-91.87111
Lighthouse Pt.	022	29.57944	-92.03444

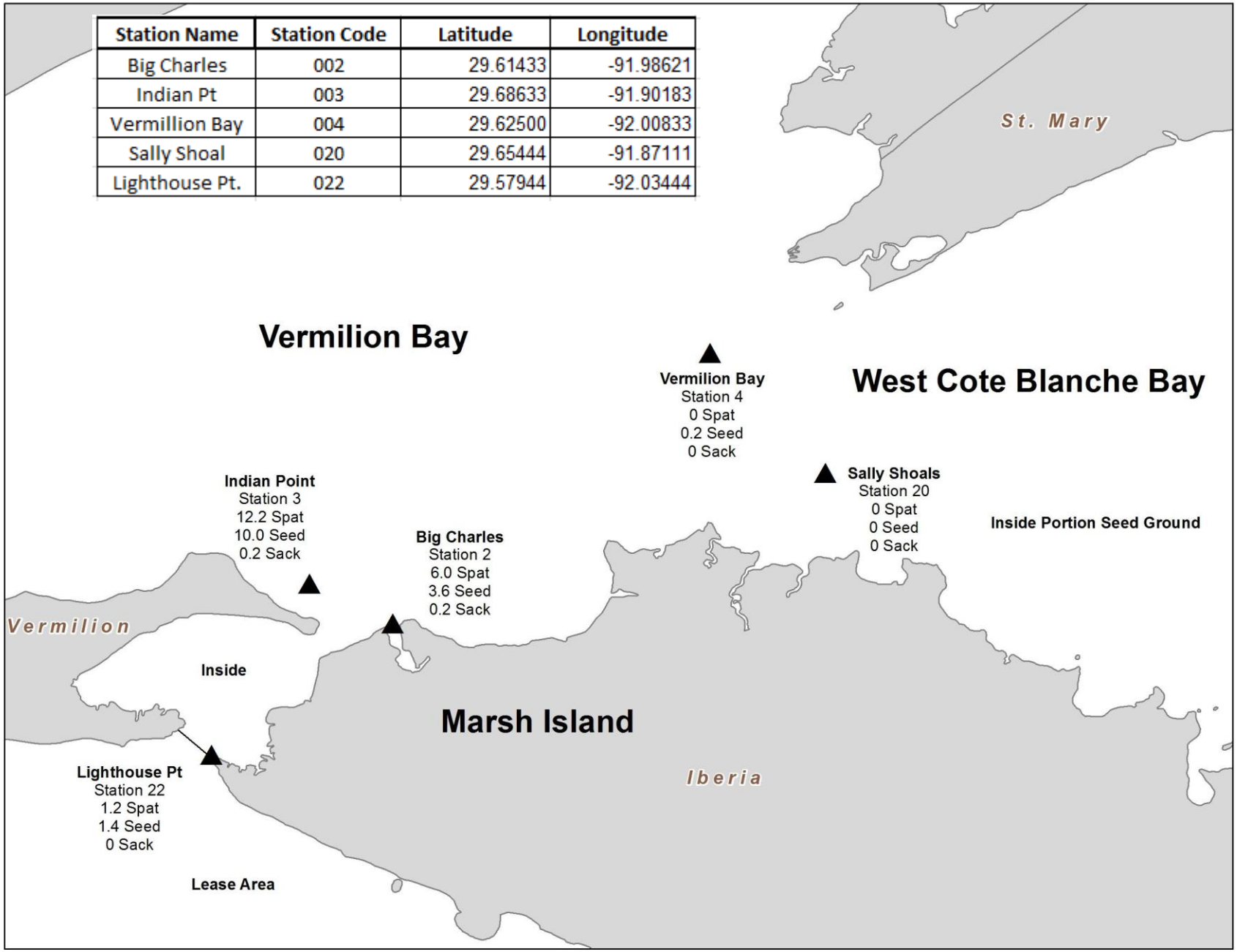

Figure 6.1 Map designating CSA6 2012 oyster square meter sample stations in the western part of the Vermilion, East and West Cote Blanche and Atchafalaya Bays public oyster seed ground. Data displayed below station numbers represent average spat, seed and sack oysters per square meter sample.

Station Name	Station Code	Latitude	Longitude
South Pt.	001	29.48333	-91.75750
Bayou Blanc	005	29.51333	-91.75833
Rabbit Island	021	29.51106	-91.59756
Middle Reef	023	29.45281	-91.72397
North Reef	024	29.47892	-91.80803

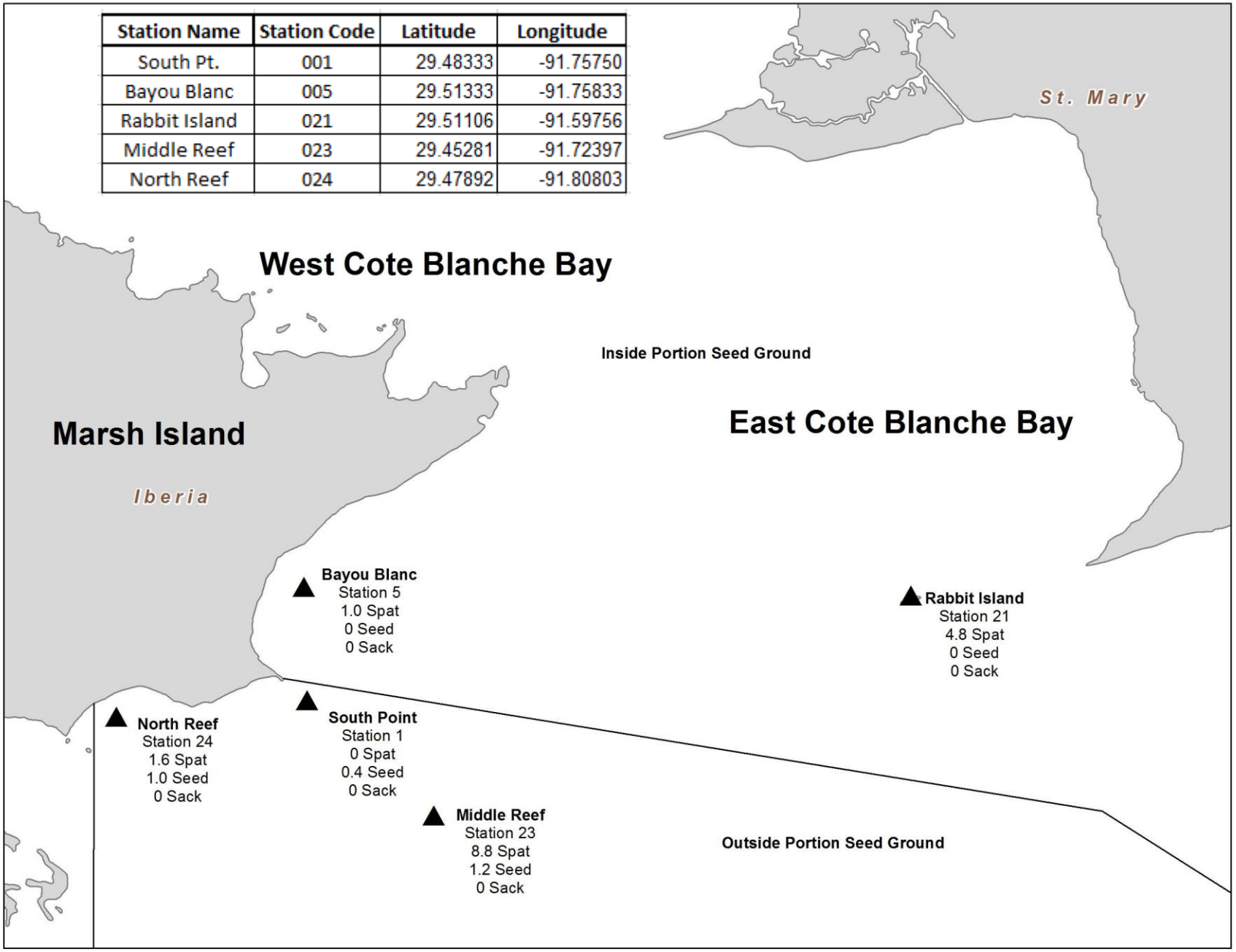

Figure 6.2 Map designating CSA6 2012 oyster square meter sample stations in the eastern part of the Vermilion, East and West Cote Blanche and Atchafalaya Bays public oyster seed ground. Data displayed below station numbers represent average spat, seed and sack oysters per square meter sample.

Year	Mean density seed/sample	Mean density sack/sample	Seed/sack ratio
1999	5.5	0.2	27.5:1
2000	81.4	3.3	24.7:1
2001	28.8	4.8	6.0:1
2002	2.25	0.25	9.0:1
2003	1.2	0	No Sack Oysters
2004	4.3	0	No Sack Oysters
2005	14.8	0	No Sack Oysters
2006	16.1	0.5	32.2:1
2007	11.6	0.8	14.5:1
2008	1.3	0	No Sack Oysters
2009	3.4	0	No Sack Oysters
2010	0.8	0.12	6.7:1
2011	0.32	0.02	16.0:1
2012	1.78	0.04	44.5:1

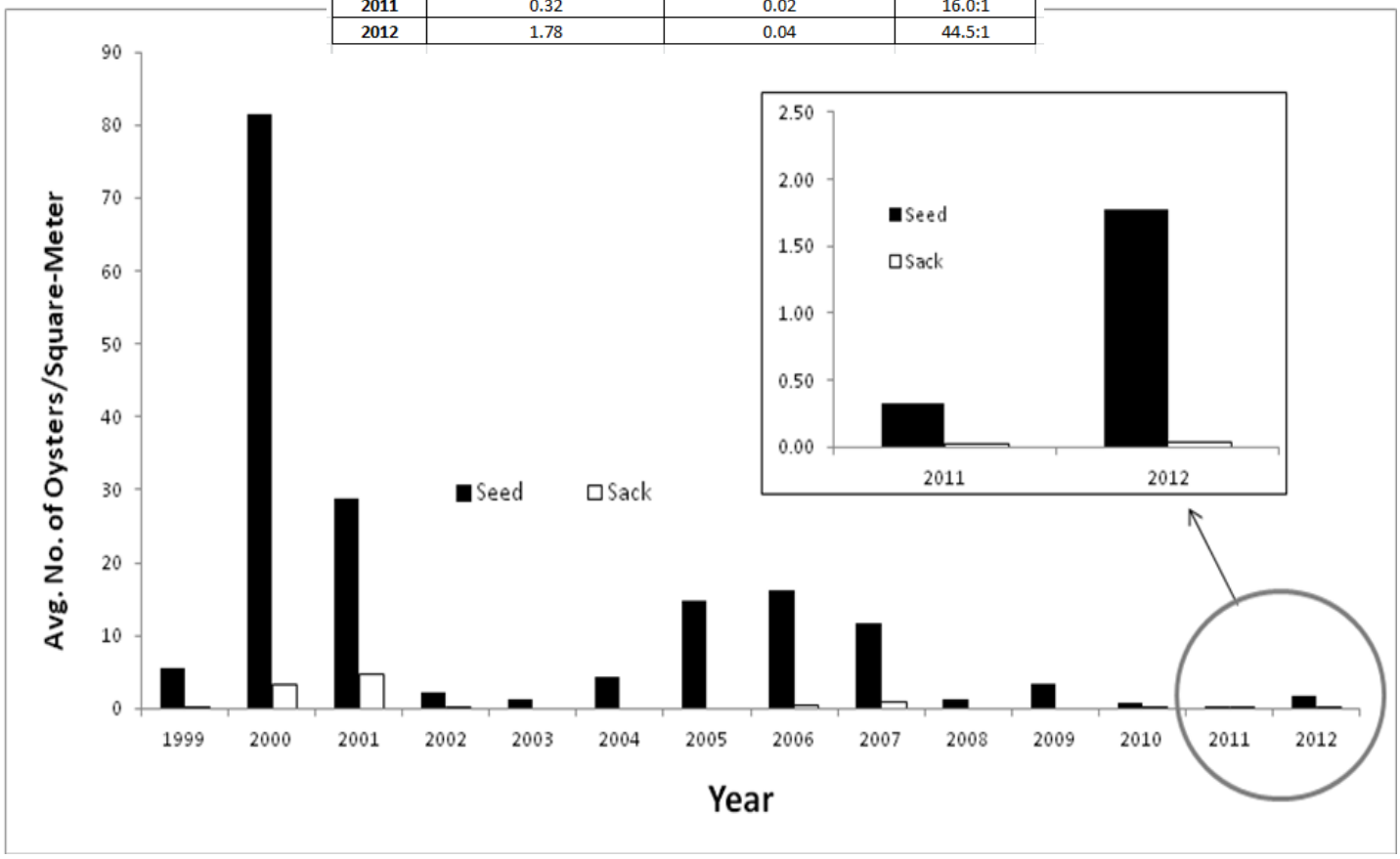

Figure 6.3. Graph depicting mean density of live seed and sack size oysters collected in CSA6 square meter samples (by year). Data table included.

Table 6.1. Mean density of the hooked mussel, *Ishadium recurvum*, recorded at each CSA6 square meter station (by year).
** 2011 was the first year for square meter samples for these stations*

Station no.	Station name	2006	2007	2008	2009	2010	2011	2012
001	South Pt./Marsh Island	16	26.0	1.0	0.0	11.2	1.4	46.4
002	Big Charles	17	16.0	2.5	0.0	18.4	5.2	21.2
003	Indian Point	9	33.5	0.5	16.0	18.2	20.4	16.6
004	Dry Reef/Vermilion Bay	0	0	2.0	37.0	0	6.6	29.8
005	Bayou Blanc	7	18.5	2.5	0.0	4	2	13.4
020*	Sally Shoals	*	*	*	*	*	3.8	25.2
021*	Rabbit Island	*	*	*	*	*	0	0
022*	Lighthouse Point	*	*	*	*	*	11.8	5.2
023*	Middle Reef	*	*	*	*	*	0.2	11.8
024*	North Reef	*	*	*	*	*	4.4	12.6

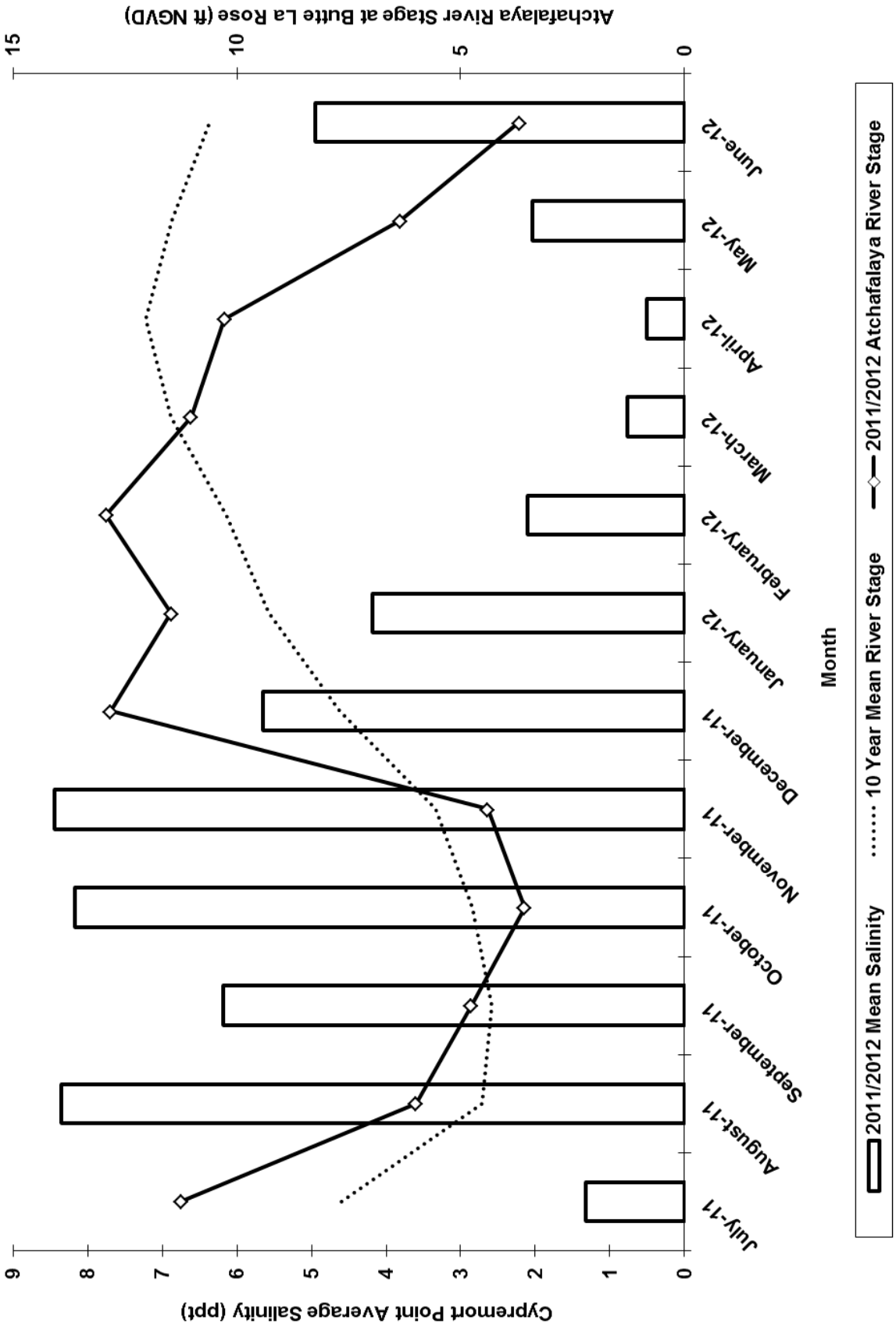

Figure 6.5. Graph depicting Atchafalaya River levels at Butte La Rose gauge and average salinity for Cypremort Point, LA during the period July 1, 2011 through June 30, 2012. Ten year average monthly river stage at Butte La Rose is included.

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Coast Study Area (CSA) 7 – 2012 Oyster Stock Assessment

Introduction

Louisiana Department of Wildlife and Fisheries' (LDWF) Coastal Study Area VII is located in Southwest Louisiana, from the Louisiana/Texas state line to Freshwater Bayou in Vermilion Parish. It is comprised of Calcasieu and Mermentau River basins and the eastern portion of the Sabine River Basin. Calcasieu Lake is located at the southern end of the Calcasieu River basin in Calcasieu and Cameron parishes. It consists of approximately 58,260 water bottom acres with oyster reefs located throughout the lake, especially in the southern end. The Mermentau River basin has no oyster harvesting areas. Sabine Lake is located at the southern end of the Sabine River basin in Cameron parish. It consists of approximately 55,057 water bottom acres with approximately 34,067 acres in the Louisiana portion and the remainder in the Texas portion. Oyster reefs are located mainly in the very southern portion of the lake.

Oyster seasons in Calcasieu Lake occurred prior to 1967, but were closed from 1967 through 1974. Oyster harvesting resumed in 1975 with only taking by hand or tongs allowed. In 2004, legislation (HB160; ACT479) was passed allowing for the use of hand oyster dredges of three feet wide or less in Calcasieu Lake. In 2006, legislation (HB802; ACT398) was passed allowing the use of mechanical retrieval systems for the dredges. In 2011, legislation (SB73, ACT329) was passed restricting oyster harvest in Calcasieu Lake to those with a Calcasieu Lake Oyster Harvest Permit. This permit is restricted to 126 oyster harvesters, 63 of which had to have trip tickets showing oyster landings from Calcasieu Lake.

Oyster seasons in Sabine Lake haven't occurred since the early 1960's based on anecdotal information; neither Texas nor Louisiana can document harvest beyond that time and no concrete harvest data has been located.

For assessment purposes, Calcasieu Lake has always been divided into two areas – Eastside and Westcove (the Calcasieu Ship Channel being the dividing line). In 1992, Louisiana Department of Health and Hospitals (LDHH) also divided the lake into two separately managed areas – Calcasieu Lake Conditional Managed Area (CLCMA) and West Cove Conditional Managed Area (WCCMA). When this change occurred the two areas were also managed for health related closures based on river stage of the Calcasieu River at Kinder, LA. CLCMA would close when the river stage reached to 12 feet and the WCCMA would close when the river stage reached 7 feet. Once the river fell below these levels for 48 hours the LDHH would reopen the areas for harvest. LDHH changed the CLCMA river stage threshold in 1998 to 13.5 feet. In 2004 LDHH changed CLCMA to Growing Area (GA) 29 and WCCMA to GA30 (Figure 7.1).

Calcasieu Lake historical season dates, DHH closures, season extensions, with notes on closures, law and management criteria changes can be seen in Table 7.6.

LDHH also limited the amount of acreage available to oyster harvest on the Eastside due to water quality standards. Oysters can only be harvested in the southern portion of the area (GA29) where water quality meets minimum standards. The total area has been changed several times over the years with the current acreage being approximately 26,736 water bottom acres. GA30 has remained the same

at approximately 9,248 acres of water bottom. The Louisiana portion of Sabine Lake (GA 31) has approximately 34,067 water bottom acres. This area was cleared by LDHH in March of 2011 for harvesting, but LDWF has not opened a season on this area at this time. Since it is cleared for harvesting by LDHH, LDWF has added the area to be assessed for oyster stocks.

Historical reef acreage for all of Calcasieu Lake is 1,690.95. West Cove consists of 726.98 acres and the Eastside consists of 963.97 acres. The historical reef acreage on the Eastside is made up of reefs that fall both within and outside of the conditional managed area. Therefore, assessments of oyster stock sizes are based on total reef acreage within the lake and not just that portion of reef acreage that lies within areas accessible to commercial fishing.

LDWF contracted ENCOS, Inc. to perform a comprehensive water bottom assessment of a portion (approximately 10,421 of 58,260 acres) of Calcasieu Lake in the latter half of 2008. GA29 assessment indicates that of the 10,421 acres assessed, 4,034.9 acres of Type II bottom (moderately firm mud, firm mud, and buried shell) and 1,434.3 acres of Type IIIB bottom (slightly covered buried shell and exposed reef) were identified. Type IIIB bottom was further categorized into: Reef, 1,003.8 acres and Exposed Shell, 430.5 acres. GA30 assessment indicates 2,190.0 acres of Type I (soft mud) bottom, 289.0 acres of Type II bottom and 2,472.8 acres of Type IIIB bottom. Type IIIB bottom was further categorized into: Reef, 369.6 acres and Exposed Shell, 2,103.2 acres. Sabine Lake was also assessed by ENCOS, Inc. in 2008 (approximately 11,405.1 of 34,067 acres). GA31 assessment indicates 6,125.2 acres of Type I bottom, 3,800.4 acres of Type II bottom and 1,479.5 acres of Type IIIB bottom. Type IIIB was categorized further into: Reef, 1,041.0 acres and Exposed Shell, 438.5 acres.

In 2011, LDWF contracted Bio-West, Inc. to perform a water bottom assessment of the remaining (those areas cleared by LDHH for oyster harvesting) portion of GA29 (19,772 acres) and GA30 (3,935 acres). GA29 assessment indicates approximately 16,433 acres of Type I bottom, 2,811 acres of Type II bottom and 528 acres of Type IIIB bottom. The Type IIIB bottom was categorized further into: Reef, 432 acres and Exposed Shell, 96 acres. GA30 assessment indicates approximately 1,882 acres of Type I bottom, 1,138 acres of Type II bottom and 915 acres of Type III bottom. The Type IIIB bottom was broken down further in Reef, 750 acres and Exposed Shell, 165 acres.

For the LDWF assessment for 2011 and all future LDWF assessments, unless another water bottom assessment is performed; all the assessments will be figured using a combination of acreages from the ENCOS, Inc. and Bio-West, Inc. assessments. GA29 will have 1,435.8 acres of Reef and 526.5 acres of Exposed Shell. GA30 will have 1,119.6 acres of Reef and 2,268.2 acres of Exposed Shell. GA31 will have 1,041.0 acres of Reef and 438.5 acres of Exposed Shell (Table 7.1).

Figures 7.2 and 7.4 indicate the Bottom type IIIB areas from 2008 and 2011 assessments for GA29, GA30 and GA31.

LDWF placed a 14.3 acre cultch plant in the southern portion of GA 30 (on the south side of the "Old Revetment") in May of 2009. No oystering was allowed by the LDWF Commission during the 2009-2010 and 2010-11 seasons on this cultch plant. This area was included in the Reef acreage of the Bio-West water bottom assessment.

Methods

The oyster assessment for Calcasieu Lake was derived by taking "meter square" samples. A one meter square frame is randomly tossed in the very near vicinity of the sample station located on a sample location of known Reef or Exposed Shell bottom. There are five replicate samples taken by a SCUBA diver at each station and there are six stations in GA29, four in GA30 and six in GA31 (Figures 7.1 and 7.3). The diver removes all live and dead oysters and shell on the top portion of the reef substrate. Any live and recent dead oysters are measured in five millimeter (mm) groups and divided into three categories – spat (<25mm), seed oysters (25mm – 74mm) and sack oysters (75mm and larger). Oyster predators, and Hooked mussels (*Ishchadium recurvum*) that are collected are identified and tallied. As no bedding (seeding) operations occur in Calcasieu Lake and all harvest is for direct market, the results of data collected are reported in sacks (seed – 360 oysters equals one sack, sack – 180 oysters equals one sack) rather than barrels (two sacks equals one barrel).

Results

Growing Area 29

The oyster assessment for GA29 indicates 0.0 sacks of sack oysters and 0.0 sacks of seed oysters available (Table 7.1). The sacks of sack oysters available on the Reef Bottoms are 0.0 and the amount on the Exposed Shell Bottoms are 0.0 (Table 7.1).

Sack oysters showed a decrease of 100.0% over the 2011 assessment of 27,007.8 sacks (Table 7.2). The availability of seed oysters showed a decrease of 100.0% over the 2011 assessment of 52,831.9 sacks (Table 7.2).

Growing Area 30

The oyster assessment for GA30 indicates 236,439.5 sacks of sack oysters and 85,171.2 sacks of seed oysters available (Table 7.1). The sacks of sack oysters available on the Reef Bottoms are 52,859.6 and the amount on the Exposed Shell Bottoms are 183,579.9 (Table 7.1).

Sack oysters showed a decrease of 60.2% from the 2011 assessment of 594,744.1 sacks (Table 7.2). The availability of seed oysters showed a decrease of 72.4% from the 2011 assessment of 308,927.2 sacks (Table 7.2).

Growing Area 31

The oyster assessment for GA31 indicates 890,693.9 sacks of sack oysters and 552,007.6 sacks of seed oysters available (Table 7.1). The sacks of sack oysters available on the Reef Bottoms are 785,207.9 and the amount on the Exposed Shell Bottoms are 105,486.0 (Table 7.1).

Sack oysters showed a decrease of 13.7% from the 2011 assessment of 1,031,976.2 sacks (Table 7.2). The availability of seed oysters showed an increase of 35.9% from the 2011 assessment of 406,141.1 sacks (Table 7.2).

2009 Cultch Plant

The oyster assessment for the 2009 cultch plant indicates no presence of spat, seed and sack oysters.

Discussion

Sack Oysters

There were no oysters found in GA29. This is a major concern.

GA30 will need to be monitored closely; the assessment indicates a 60.2% (Table 7.2) drop in sack oysters as compared to the 2011 stock assessment. Of even more concern is that the sack oysters from the Reef Bottoms dropped 63.8% from the 2011 assessment. Most fishing pressure occurs on the Reef Bottom type.

Calcasieu Lake oyster landings data via the LDWF Trip-Ticket program indicated that there were 29,666 sacks reported landed in the 2011-12 season (Table 7.3). These landings were just from GA30 as GA29 was not open for harvest. This is the first year that GA29 has been closed since trip ticket data has been available. It was not possible to separate GA29 and GA30 landings in previous years, so there is no trip ticket data to indicate if the above landings are higher or lower from previous years in GA30. It is estimated that about 48,079 sacks of the last seasons harvest came from GA30 (derived from CSA7 boat count harvest estimates). Landings from Calcasieu Lake from dealer report (started in 1991) and later trip tickets are shown with the assessments in Figure 7.9.

GA31 has 890,693.9 sacks of sack oysters available, this is down 13.7% over the 2011 assessment. At this time there is no season on GA31.

Seed Oysters

Seed oysters decreased in GA29 by 100.0% from the 2011 assessment (Table 7.2). Seed oysters decreased in GA30 by 72.4% from the 2011 assessment (Table 7.2). Seed oysters in GA31 increased 35.9% from the 2011 assessment (Table 7.2)

Hydrology

Average water temperatures for May and June were 25.3^{o}C and 29.5^{o}C respectively and were above the long term average (LTA) of 1970-2011 (Table 7.5). The average water temperature during the oyster assessment was 30.7^{o}C which is slightly higher that the LTA of 29.6^{o}C.

Average salinities (in parts per thousand - ppt) for May and June were 12.1ppt and 18.6ppt respectively; this is higher than the LTA for the same months (Table 7.5). The average salinity during the oyster assessment was 18.6ppt which is above the LTA of 12.7ppt.

Disease, Fouling Organisms, and Predators

Hooked mussels continue to be about the same as the 2011 assessment in GA29 and 31. There was only one found in the GA29 samples. Hooked mussels were present in GA30 averaging 22.7 per sample station, this is down from the 2011 assessment of 200.7 per sample station. The 2012 assessment of GA31 showed there to be 639.2 Hooked mussels per sample station compared to the 613.5 per sample station in 2011. The high numbers in GA31 could be attributed to no oyster dredge activity on the reefs.

There have been very few Southern oyster drills *Stramonita haemastoma*) present in either the meter square or dredge samples before 2009. Upon review of dredge data since 2005, numbers of the oyster drills (a predatory marine snail) began to increase in dredge samples in 2009. With the drought in mid 2010 through 2011, the number increased greatly, with a total collected in 2011 of 421 and 2012 of

171 (Jan. – June), (Figure 7.10). A freshwater influx February – April 2012 didn't seem to alter the numbers of oyster drills. There were a total of 5 oyster drills collected during this assessment in GA29. This is lower than the 20 caught in 2011and the 13 in 2010. Though the number of oyster drills is lower in the square meter samples, the number continues to be high in the dredge samples, (Figure 7.11). With above-average harvest issues in 2009-2010 (Table 7.3), then the influx of oyster drills in 2010 to present (Figure 7.10), the oyster population in GA29 continues to have recruitment issues. There were no oyster drills collected in the square meter samples from GA30 or 31.

There was a total of 134 unidentified mud crabs found in the samples from all three growing areas. No other species of concern were found.

Future assessments
All the areas open to oystering in GA29, 30 and 31 that likely have oysters have had bottom surveys completed. The upper half of Calcasieu Lake hasn't been surveyed, but is not available at this time to oyster fishing because of LDHH closure. The upper area of Sabine Lake probably has few if any oysters and will not need bottom surveying at this time.

2011-12 Oyster Season

The Louisiana Wildlife and Fisheries Commission did not open GA29 for the 2011-12 season. GA 30 opened November 1, 2011 and closed April 30, 2012. The sack limit was set at 10 sacks per day for the entire season. GA31 remained closed.

With the low numbers of available oysters on the eastern oyster areas of the state, demand continues to be high. As mentioned above, a permit system was put into place limiting the number of oyster harvesters in Calcasieu Lake to 126. The average number of different vessels harvesting oysters in the 2011-12 season was 58. The highest month was January 2012 with 85 different vessels harvesting oysters (Figure 7.8).

With GA 29 closed, all the fishing pressure was in GA30. Landings from GA 30 were 29,666 sacks (Table 7.3). With lower numbers of vessels fishing, average of 58 different boats per month, and LDHH health closures closing the season 48% of the time (Table 7.4), landings are down from the estimated 48,079 sacks landing from GA30 for the 2010-11 season.

2012-13 Oyster Season

SB202 passed and became ACT541 and, at this time, will be effective for the 2012-13 season. This act will maintain the Calcasieu Lake Oyster Harvester permit requirement, but remove certain permit qualification requirements and remove the limit on the number of permits issued by LDWF.

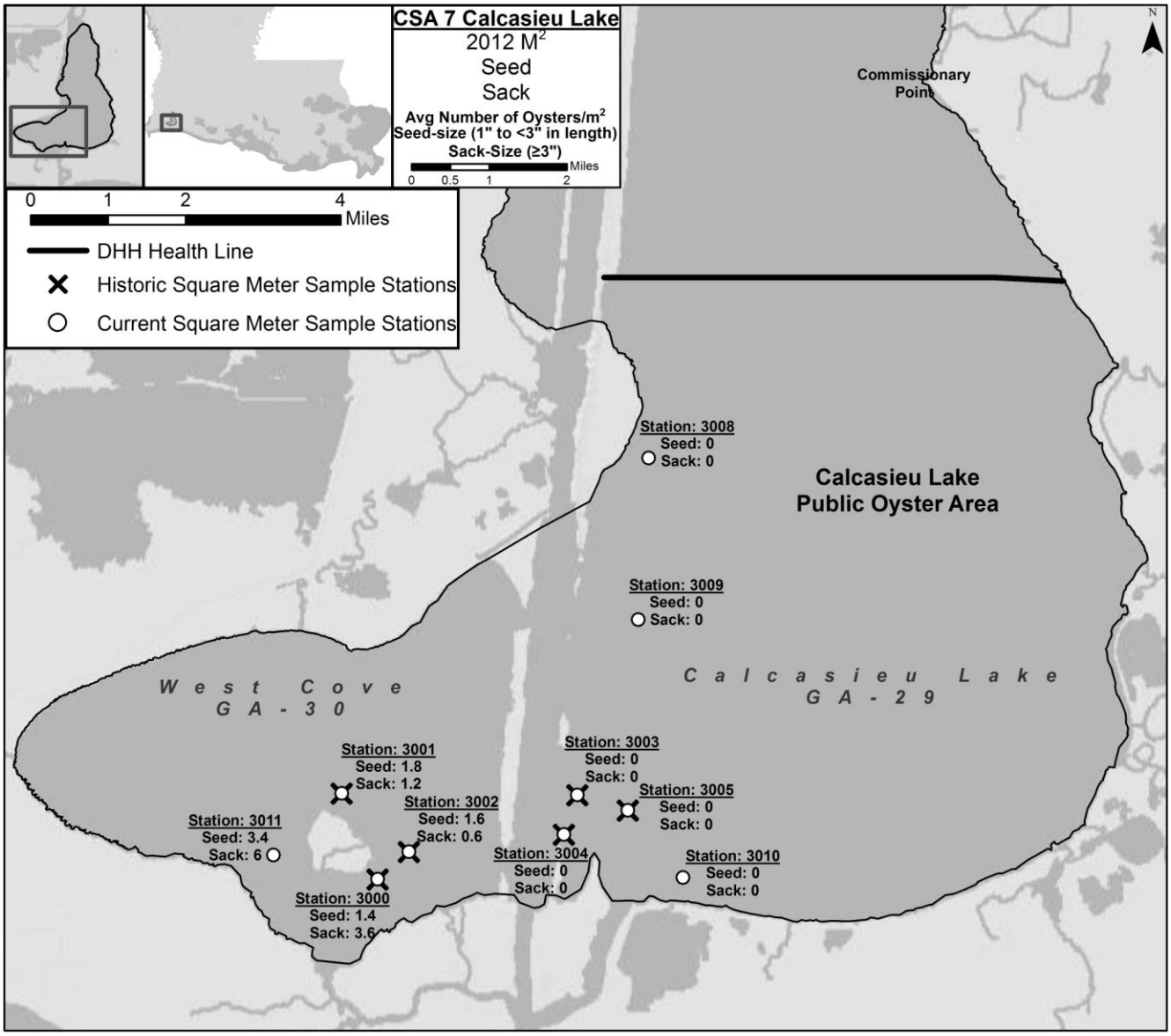

Figure 7.1. The Calcasieu Lake Public Oyster Area indicating the two conditional management area (GA 29 east of the Calcasieu Ship Channel and GA 30 west of the channel), as well as the 2012 oyster square meter sample stations.

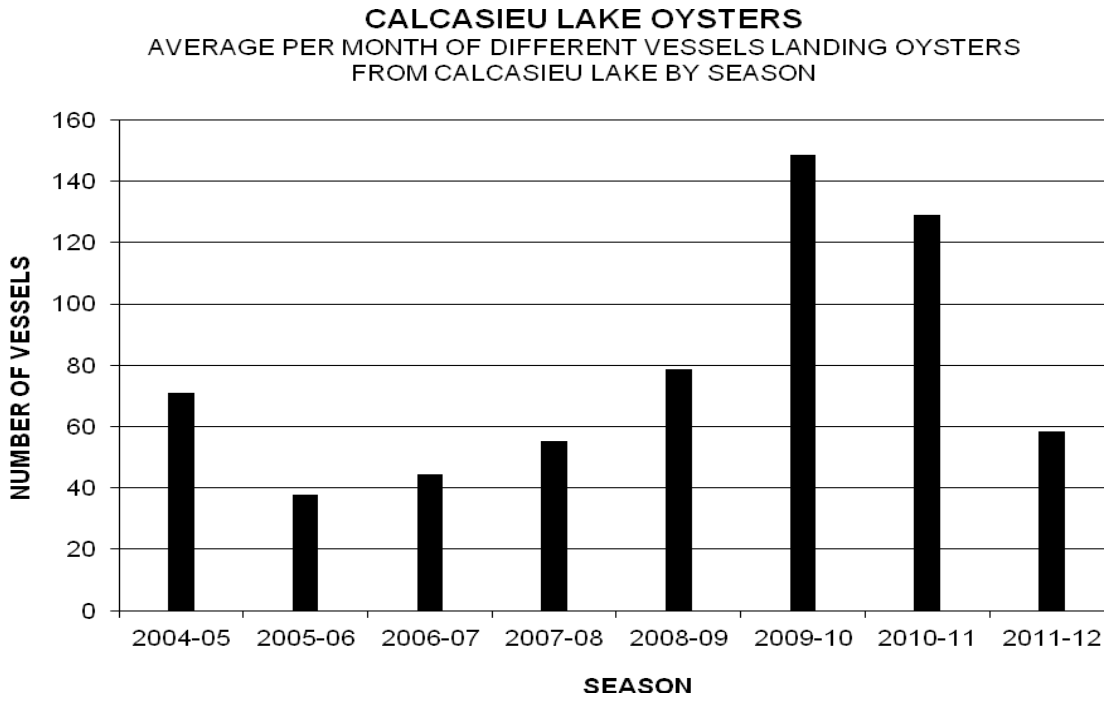

Figure 7.8. Monthly average of boats landing oysters from Calcasieu Lake (GA29 and 30).

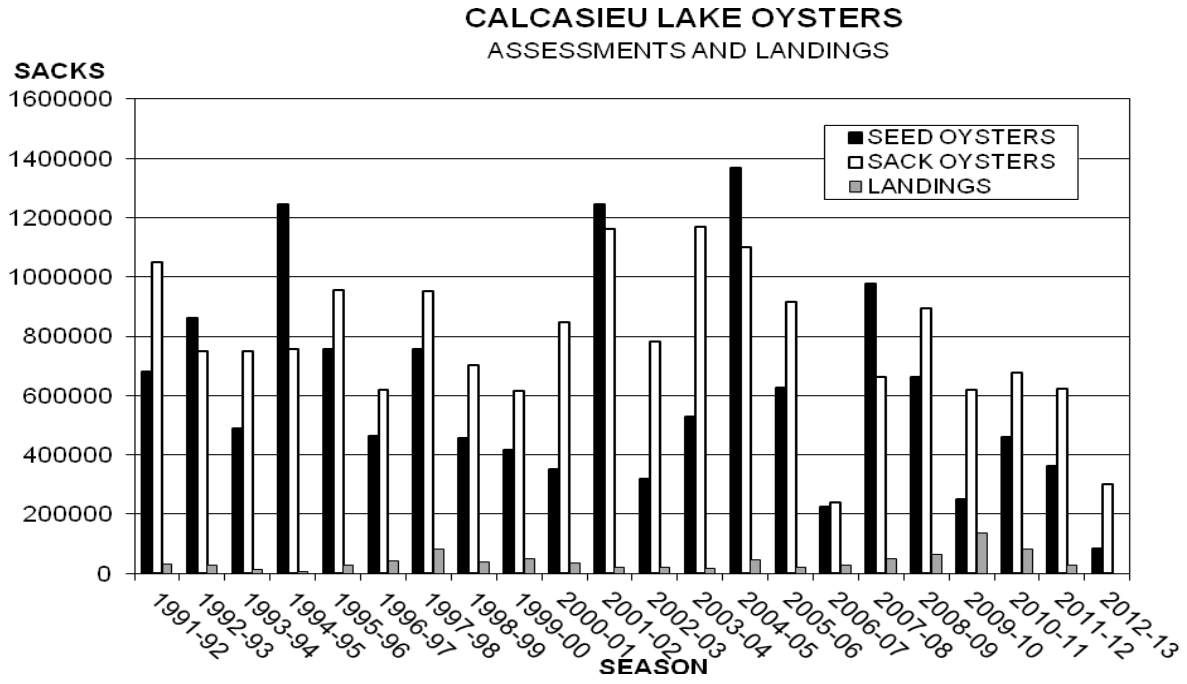

Figure 7.9. Calcasieu Lake Available Oysters and Landings.

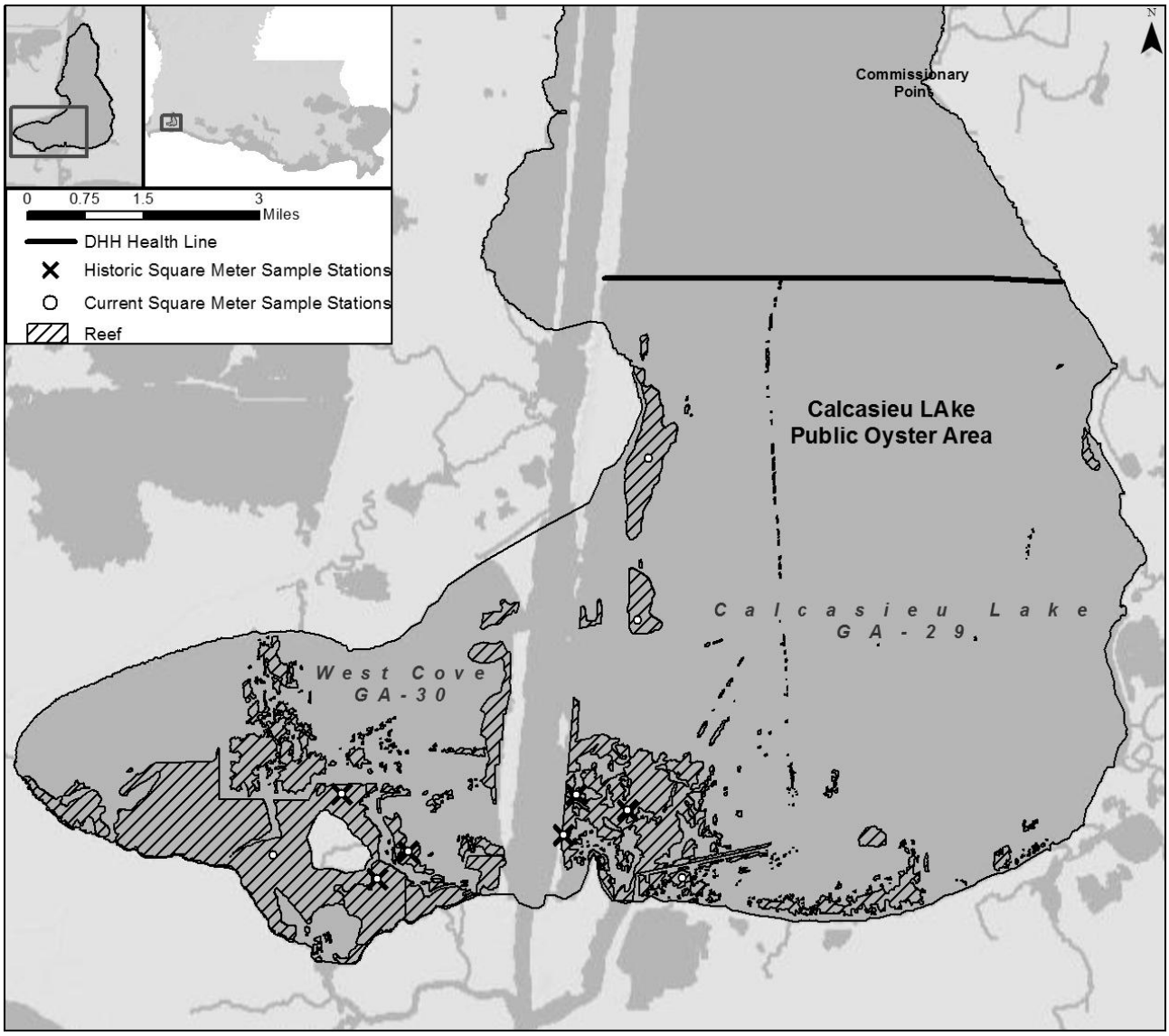

Figure 7.2. Oyster habitat (Bottom type IIIB) coverage within the Calcasieu Lake Public Oyster Area as delineated by ENCOS 2008 and Bio-West 2011 water bottom assessments.

Table 7.3. Historical oyster stock assessments and landings from Calcasieu Lake (in sacks).

SEASON	STOCK ASSESSMENT		ESTIMATED SACKS HARVESTED
	MARKETABLE	TOTAL (MARKET AND SEED OYSTERS)	
1963	-	-	210,160
1967-74	-	-	NO COMMERCIAL LANDINGS
1975-76	142,726	441,183	40,000
1976-77	694,420	869,475	100,000
1977-78	483,673	621,885	141,976
1978-79	-	-	75,000
1979-80	676-333	979,613	125,000
1980-81	355,664	705,117	150,000
1981-82	608,110	988,575	-
1982-83	-	-	50,000-75,000
1983-84	-	-	150,000
1984-85	125,407	644,788	-
1985-86	315,160	537,760	27,400
1986-87	589,940	1,217,959	200,000
1987-88	796,950	2,703,647	125,000
1988-89	463,331	1,036,580	50,000
1989-90	172,046	640,892	40,000
1990-91	408,961	1,268,962	50,000
1991-92	1,048,882	1,731,367	31,383[1]
1992-93	749,915	1,612,736	27,328
1993-94	748,281	1,238,783	12,818
1994-95	756,525	1,246,480	6,134
1995-56	956,926	1,298,379	29,082
1996-97	618,767	1,083,866	43,441
1997-98	950,979	1,706,510	80,735
1998-99	702,371	1,160,115	39,202[2]
1999-00	614,145	1,032,117	58,960
2000-01	846,176	1,197,311	35,881
2001-02	1,163,750	2,409,482	21,297
2002-03	781,676	1,100,257	21,386
2003-04	1,169,997	1,700,663	18,196
2004-05	1,099,236	2,468,560	44,293
2005-06[3]	915,625	1,541,893	19,327
2006-07[4]	238,945	463,623	28,341
2007-08	662,747	1,638,496	49,529
2008-09	894,262	1,556,465	63,948[5]
2009-10[6]	621,006	873,099	137,074
2009-10[7]	1,398,437	1,972,920	
2010-11[8]	712,916	1,327,445	82,896
2011-12[9]	648,773	1,062,789	29,666
2012-13	302,732	387,913	

1 – STARTED USING DEALER REPORTS FOR LANDINGS.
2 – THE 1999 PORTION OF THE LANDINGS WAS DERIVED FROM PRELIMINARY TRIP TICKET DATA.
3 – HURRICANE RITE MADE LANDFALL ON 9/23/05 IN CAMERON PARISH, DELAYING SEASON OPENING, LIMITING THE NUMBER OF FISHERMEN AND BUYERS.
4 – A SEWAGE LINE BREAK IN BAYOU D'INDE CLOSED THE SEASON IN FOR THE ENTIRE MONTH OF APRIL, LIMITING THE LANDINGS.
5 – NO DATA WAS AVAILABLE FOR OCT.2008.
6 – ASSESSMENT USING THE REGULAR REEF ACREAGE.
7 – ASSESSMENT USING THE UPDATED REEF ACREAGE FROM ENCOS (2008).
8 – USING THE UPDATED REEF ACREAGE (2008) AND USING FIVE REPLICATES INSTEAD OF TWO.
9 – USING THE 2011 UPDATED REEF ACREAGE, ENCOS (2008) AND BIO-WEST (2011), FOR THE 2011-12 SEASON AND BEYOND

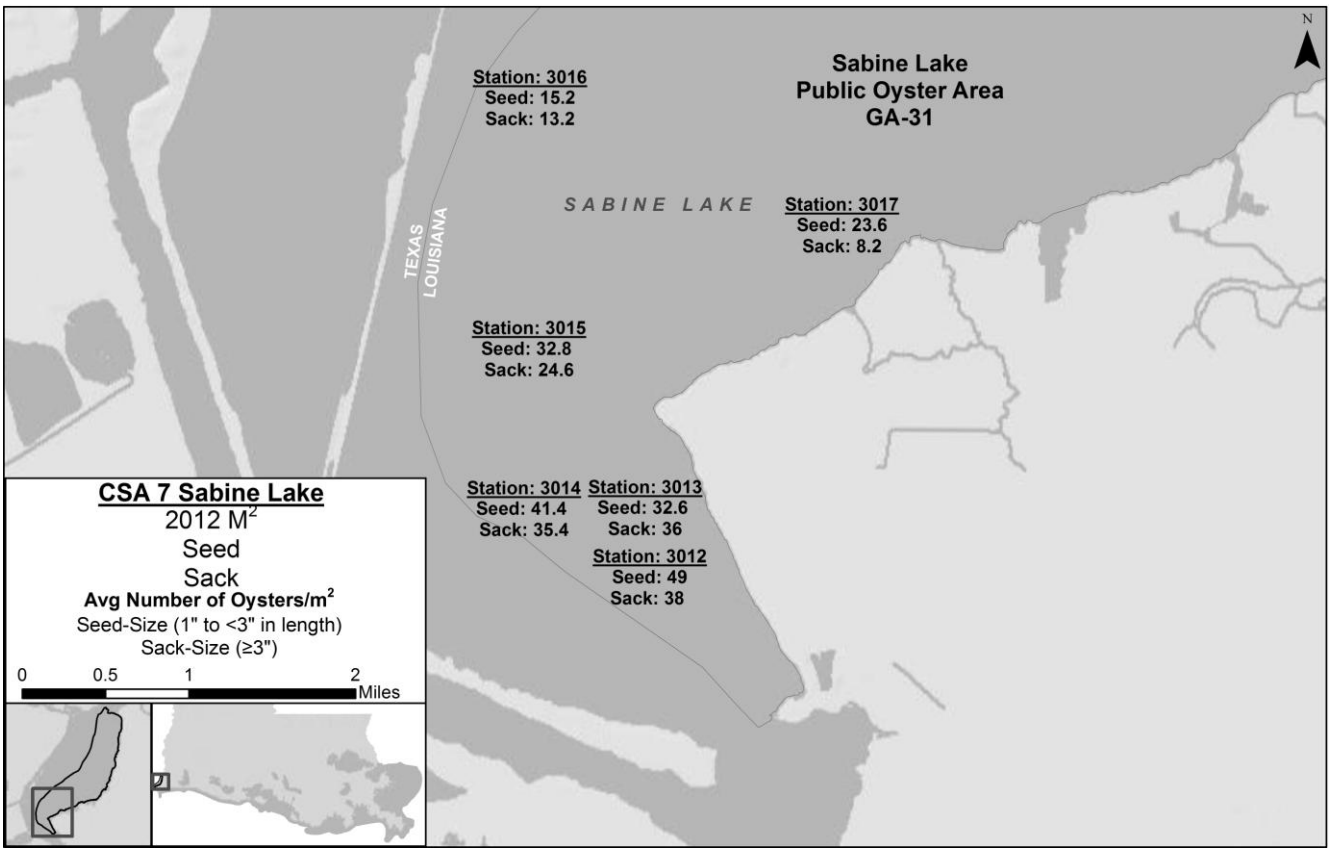

Figure 7.3. The 2012 oyster square meter sampling stations and results within the Sabine Lake Public Oyster Area.

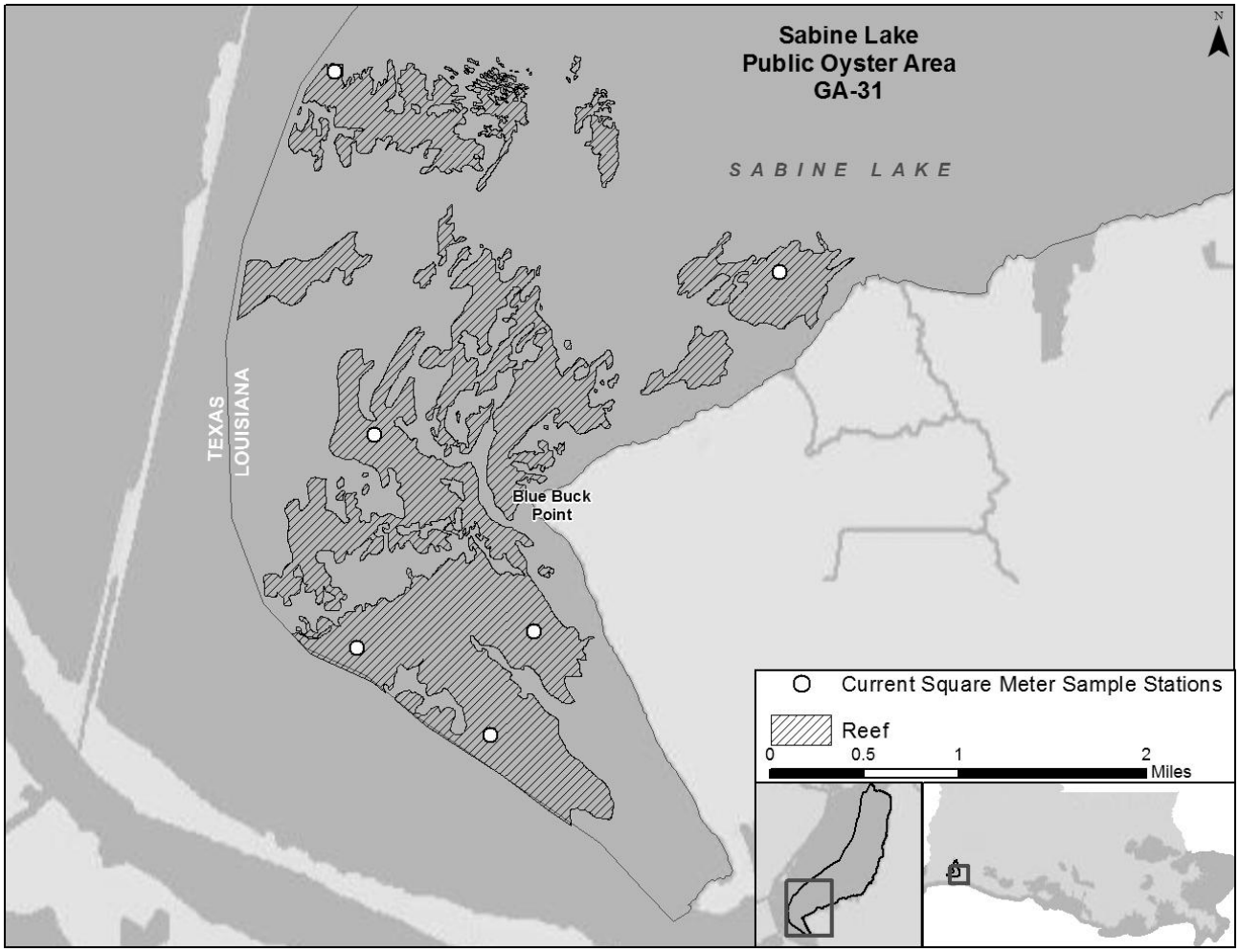

Figure 7.4. Oyster habitat (Bottom type IIIB) coverage within the Sabine Lake Public Oyster Area as delineated by ENCOS 2008 water bottom assessment.

Table 7.1. 2012 Estimated Oyster Availability on Public Oyster Areas in CSAVII.

PUBLIC OYSTER AREA	BOTTOM TYPE IIIB	REEF ACREAGE	SQUARE METERS	SEED OYSTERS PER M^2	SACK OYSTERS PER M^2	SACKS OF SEED OYSTERS	SACKS OF SACK OYSTERS
GA29	REEF	1,435.8	5,810,424.156	0.00	0.00	0.0	0.0
	EXPOSED SHELL	526.5	2,130,650.730	0.00	0.00	0.0	0.0
GA30	REEF	1119.6	4,530,819.672	1.50	2.10	18,878.4	52,859.6
	EXPOSED SHELL	2,268.2	9,178,997.124	2.60	3.60	66,292.8	183,579.9
GA31	REEF	1,041.0	4,212,739.620	39.00	33.55	456,380.1	785,207.9
	EXPOSED SHELL	438.5	1,774,530.570	19.40	10.70	95,627.5	105,486.0
TOTALS						637,178.8	1,127,133.4

Table 7.2. Calcasieu Short Term Assessments and Percentage Change.

ASSESSMENTS BY CONDITIONAL MANAGED AREA						
	SACK OYSTERS (≥ 3")			SEED OYSTERS (< 3")		
YEAR	GA29	GA30	GA31	GA29	GA30	GA31
2007	548,333.3	114,414.1	NA	598,181.8	337,566.5	NA
2008	752,061.9	142,199.9	NA	449,720.0	212,483.3	NA
2009[1]	612,687.3	711,613.6	NA	191,435.5	422,520.6	NA
2010[1]	23,540.1	689,375.7	478,985.9	8,545.3	605,983.5	436,409.4
2011[2]	27,007.8	594,744.1	1,031,976.2	52,831.9	308,927.2	406,141.1
AVERAGE	**392,726.1**	**450,469.5**	**755,481.1**	**260,142.9**	**377,496.2**	**421,275.3**
2012	0.0	236,439.5	890,693.9	0.0	85,171.2	552,007.6
% CHANGE FROM AVE.	-100.0	-47.5	+17.9	-100.0	-77.4	+31.0
% CHANGE FROM 2011	-100.0	-60.2	-13.7	-100.0	-72.4	+35.9

1 – assessed using updated reef acreage from ENCOS (3,907.1) in 2008.
2 – assessed using updated reef acreage from ENCOS (2008) and Bio-West (2011).

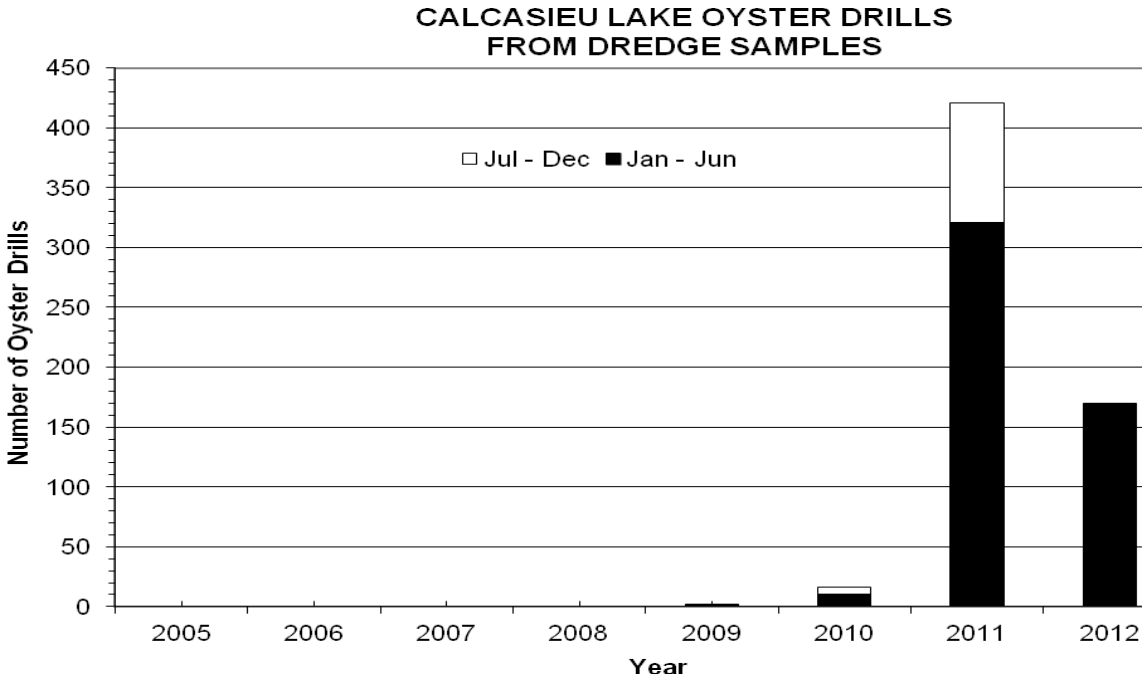

Figure 7.10. Total oyster drills collected in monthly dredge samples from Calcasieu Lake.

Table 7.4. Calcasieu Lake Percent of Season Days Open.

SEASON		TOTAL DAYS	LOWER CALCASIEU LAKE CMA GA29		WEST COVE CMA GA30	
			OPEN DAYS	PERCENTAGE	OPEN DAYS	PERCENTAGE
1991-92		199	114	57	114	57
1992-93[1]		165	137	83	76	46
1993-94		181	146	81	84	46
1994-95		181	90	50	9	5
1995-96		188	175	93	115	61
1996-97		197	149	76	114	58
1997-98		197	139	71	96	49
1998-99		197	135	69	120	61
1999-00		197	197	100	182	92
2000-01		198	180	95	106	53
2001-02		198	158	80	61	31
2002-03		198	146	74	66	33
2003-04		199	172	87	126	63
2004-05		198	168	85	68	34
2005-06[2]	LCLCMA	198	187	94		
	WCCMA	205			165	40
2006-07	LCLCMA	181	118	65		
	WCCMA	197			70	35
2007-08	LCLCMA	182	165	91		
	WCCMA	199			131	66
2008-09	LCLCMA	198	183	92		
	WCCMA				125	63
2009-10	LCLCMA	198	157	79		
	WCCMA				80	40
2010-11[3]	GA29	131	131	100		
	GA30	196			186	95
2011-12	GA29	Closed	0	0		
	GA30	175			91	52

1 - 92-93 SEASON STARTED USING CALCASIEU RIVER GAUGE AT KINDER FOR DHH CLOSURES.
2 - STARTING WITH THE 2005-06 SEASON, THE LAKE WAS DIVIDED INTO TWO CONDITIONAL MANAGED AREAS (CMA), WERE MANAGED SEPERATELY AND MAY HAVE DIFFENENT LENGTH SEASONS.
3 - STARTING WITH THE 2010-11 SEASON THE CONDITIONAL MANAGED AREAS WERE CHANGED TO GROWNING AREAS (GA).

Table 7.5. Calcasieu Lake Salinity and Temperature.

2012 HYDROLOGY								
	GA29		GA30		GA31		LONG TERM (CALCASIEU LAKE)[1]	
MONTH	AVE. SAL.	AVE. TEMP.	AVE. SAL.	AVE. TEMP.	AVE. SAL.	AVE. TEMP.	AVE. SAL.	AVE. TEMP.
MAY DREDGE SAMLES	16.4	24.6	14.0	26.2	6.0	25.2	11.3	25.2
JUNE DREDGE SAMPLES	19.8	30.7	19.9	27.6	16.0	30.3	11.6	28.3
JULY SQ. MTR. ASSESSMENT	19.7	31.8	18.7	29.9	17.5	30.4	12.7	29.6

1 – Longterm is only available from Calcasieu Lake, from 16'trawl data.

Table 7.6. Calcasieu Lake oyster season information.

SEASON		REGULAR SEASON							EXTENDED SEASON							TOTAL DAYS IN SEASON
		DATES			DHH HEALTH CLOSURES				DATES			DHH HEALTH CLOSURES				
					CAL. L. CMA		WEST COVE CMA					CAL. LAKE CMA		WEST COVE CMA		
		OPEN DATE	CLOSED DATE	TOTAL DAYS	DAYS OPEN	DAYS CLOSED	DAYS OPEN	DAYS CLOSED	OPEN DATE	CLOSED DATE	TOTAL DAYS	DAYS OPEN	DAYS CLOSED	DAYS OPEN	DAYS CLOSED	
1989-90		11-15	3-15	121	79	42	79	42	3-16	4-30	46	40	6	40	6	165
1990-91		11-15	3-1	147	95	52	95	52	3-30	4-20	34	20	0	0	0	181
1991-92		10-15	3-1	139	69	70	69	70	3-2	4-30	60	45	15	15	15	199
1992-93[1]		10-15	3-1	138	123	15	76	62	3-8	4-3	27	14	13	13	27	165
1993-94		11-1	3-1	121	94	27	61	60	3-2	4-30	60	52	8	8	7	181
1994-95[2]		11-1	3-1	121	69	52	9	112	3-2	4-30	60	21	39	39	60	181
1995-96		10-16	3-1	138	125	13	80	58	3-2	3-31	30	30	0	0	0	-
									4-11	4-30	20	20	0	0	15	188
1996-97		10-16	5-1	197	149	48	83	114	-	-	-	-	-	-	-	197
1997-98		10-16	4-30	197	139	58	101	96	-	-	-	-	-	-	-	197
1998-99[3]		10-16	4-30	197	135	62	77	120	-	-	-	-	-	-	-	197
1999-00		10-16	4-30	197	197	0	182	15	-	-	-	-	-	-	-	197
2000-01		10-15	4-30	198	180	18	106	92	-	-	-	-	-	-	-	198
2001-02		10-15	4-30	198	158	40	61	137	-	-	-	-	-	-	-	198
2002-03		10-15	4-30	198	146	52	66	132	-	-	-	-	-	-	-	198
2003-04		10-15	4-30	199	172	27	126	73	-	-	-	-	-	-	-	199
2004-05[4]		10-15	4-30	198	168	30	68	130	-	-	-	-	-	-	-	198
2005-06	LCLCMA	10-15	4-30	198	187	11			-	-	-	-	-	-	-	198
	WCCMA	10-8	4-30	205			165	40	-	-	-	-	-	-	-	205
2006-07[5]	LCLCMA	11-1	4-30	181	118	63			-	-	-	-	-	-	-	181
	WCCMA	10-16	4-30	197			70	127	-	-	-	-	-	-	-	197
2007-08	LCLCMA	11-1	4-30	182					-	-	-	-	-	-	-	181
	WCCMA	10-15	4-30	199					-	-	-	-	-	-	-	198
2008-09	LCLCMA	10-15	4-30	198	183	15			-	-	-	-	-	-	-	198
	WCCMA						125	73	-	-	-	-	-	-	-	
2009-10	GA29	10-15	4-30	198	157	41			-	-	-	-	-	-	-	198
	GA30						80	118	-	-	-	-	-	-	-	
2010-11	GA29	11-15	3-25[7]	131	131	0			-	-	-	-	-	-	-	131
	GA30[6]	10-15	4-30	196			186	10	-	-	-	-	-	-	-	196
2011-12[8]	GA 29[9]	CLOSED		0												0
	GA 30	11-1	4-30	175			91	84								175

1 - STARTING WITH THE 92-93 SEASON CALCASIEU LAKE WAS SPLIT INTO TWO UNITS: CAL. LAKE CMA (W/ RIVER STAGE CLOSURE @ 12 FT.) AND WEST COVE CMA (W/ RIVER STAGE CLOSURE @ 7 FT.).
2 - DHH CLOSED THE CAL. LAKE CMA (FROM 11/1-12/10/94) AND WEST COVE (FROM 11/1-1/28/95) WITH A PRECAUTIONARY (POSSIBLE LEAD CONTAMINATION) CLOSURE.
3 - DURING THIS SEASON THE RIVER LEVEL CRITERIA IN THE CAL. LAKE CMA CHANGED FROM 12 TO 13.5 FT.
4 - NEW LEGISLATION ALLOWING THE USE OF HAND DREDGES UP TO 36" BEGINS WITH THIS SEASON.
5 - ACT 398 ALLOWING THE USE OF MECHANICAL ASSIST BEGINS WITH THIS SEASON.
5 - FROM 10-15 THROUGH 11-14, THE SACK LIMIT WAS 20; SACK LIMIT REVERTED TO 10 FOR THE REMAINDER OF THE SEASON IN BOTH GROWING AREAS.
6 - GA29 CLOSED DUE TO HEAVY HARVEST PRESURE OF THE RESOURCE; SEE LDWF NEWS RELEASE 3/22/11.
8 - OYSTERING FROM CALCASIEU LAKE FOR THE 2011-12 SEASON WAS BY SPECIAL PERMIT ONLY, SEE NEWS RELEASE FROM 7/7/11 AND 9/15/11.
9 - GA 29 WAS CLOSED. SEE NEWS RELEASE FROM 9/1/2011.

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Levels of the parasite *Perkinsus marinus* in populations of oysters from the Louisiana Public Seed Grounds: Summer 2012

by

Thomas M. Soniat, Ph.D.

30 July 2012

Among the most significant causes of oyster mortality is the parasite *Perkinsus marinus*, responsible for annual mortality rates that exceed 50% in many populations of adult eastern oysters, *Crassostrea virginica*. *Perkinsus marinus* was described in 1950 by John Mackin, Malcolm Owen and Albert Collier as *Dermocystidium marinum* – hence the common name "Dermo" which is still in use (Mackin et al. 1950).

The discovery of the parasite was the result of investigations (funded by a consortium of oil companies and directed by Texas A&M University) of the impact of oil and gas activities on the Louisiana oyster industry (Mackin and Hopkins, 1962). Extensive studies were conducted on the effects of crude oil, bleed water, natural gas, drilling mud and seismographic surveys. It was ultimately realized that none of these pollutants or activities explained the widespread mortalities of oysters that were observed. It is now known that the parasite is a major cause of oyster mortality from Maine to Mexico (Soniat, 1996).

The critical environmental factors which favor the proliferation of the parasite are high water temperatures and high salinities. Thus infections are more intense in the late summer, on the seaward side of estuaries and during droughts. Drought conditions on the Gulf Coast are associated with the La Niña phase of El Niño Southern Oscillation; however, increases in prevalence (percent infection, PI) precede sharp increases in intensity (weighted prevalence, WP) and epizootics of Dermo in Louisiana can lag La Niña events by about 6 months (Soniat et al., 2005). Management techniques to minimize disease and increase oyster harvest include moving infected oysters to lower salinity, early harvest of infected populations, and even freshwater diversion into high-salinity estuaries. Because of the key role of Dermo as a cause of oyster mortality, the success of oyster farming depends on the ability to manage oyster populations in the presence of high levels of disease (Soniat and Kortright, 1998).

The standard assay for determining the level of parasitism is the fluid thioglycollate method (Ray, 1966). A small piece tissue is removed and assayed for disease after incubation in fluid thioglycollate and antibiotics for one week. *P. marinus* intensity is scored using a 0-to-5 scale developed by Mackin (1962), where 0 is no infection and 5 is an infection in which the

oyster tissue is almost entirely obscured by the parasite. Calculations are made of percent infection (PI) and weighted prevalence (WP), which is the sum of the disease code numbers divided by the total number of oysters in the sample. A WP of 1.5 could be considered a level at which disease-related mortalities are occurring. For example, Mackin (1962) claims: a population of live oyster with a weighted prevalence of 2.0 "contains an intense epidemic, and more than half of the population may be in advanced stages of the disease, with all of the individuals infected."

Oysters for the summer 2012 study were collected from 20 sites across coastal Louisiana. Samples were taken from Three Mile Pass (TM) in Mississippi Sound; Lonesome Island (LI), North Black Bay (NB), South Black Bay (SB), Telegraph Point (TP), Bay Crabe (BC), Horseshoe Reef (HR), and Bay Gardene (BG) in the Breton Sound area; mid Hackberry Bay (HB) in the Barataria system; Lake Felicity (LF) and Lake Chien (LC) in the Terrebonne Bay region; Grand Pass (GP) and Old Camp (OC) in Sister Lake; Bayou DeWest (DW) and Buckskin Bayou (BB) in Bay Junop; South Point (SP) and Indian Point (IP) in Vermilion Bay; Northeast Rabbit Island (NE) and Commissary Point (CP) in Lake Calcasieu; and a single Sabine Lake (SL) site.

An attempt was made to assay 10 market-sized (≥ 75 mm) oysters and 10 seed (25-74 mm) oysters from each site. However, in some cases insufficient oysters were available to satisfy that standard. With the exception of Three-Mile Pass (Mississippi Sound area), insufficient numbers of seed oysters were available from stations east of the Mississippi River. No market-sized oysters were available from South Point in the Vermilion Bay area (Table 1). The length of oysters was measured to the nearest mm; mantle tissue was removed from each oyster, incubated at room temperature in fluid thioglycollate for about a week, and assayed according to the standard Ray (1966) technique. The level of infection (disease code) was scored from 0 to 5, where 0 is no infection and 5 is near total coverage of the oyster tissue by the parasite. Weighted prevalence (WP) was calculated by summing the disease code values and dividing by the number of oysters in the sample.

Weighed prevalence (WP) and percent infection (PI) results are shown in Table 8-1. This year's results show low levels of disease across the State. This was particularly evident in stations east of the Mississippi River; samples from six of eight stations there (LI, NB, SB, BC, HR) showed no evidence of Dermo, and at TM and TP disease levels were low (20% infection and low WPs). Seed oysters from the lone Barataria Bay site (HB) showed a 30% PI and a 0.13 WP; 20% of market oysters were infected with a WP of 0.07. Terrebonne Bay stations (LF, LC) showed slightly higher Dermo levels than those from last year, but are still at low levels. Sister Lake stations (GP, OC) showed disease levels lower or equivalent to those from last year, and Bay Junop (DW, BB) stations showed slightly higher levels. Oysters from the Vermilion Bay area stations (SP. IP) were uninfected. Oysters from the Northeast Rabbit Island station had the highest levels of infection in the 2012 survey, but not significantly differently than levels from last year. A new station was sampled from eastern Lake Calcasieu, Commissary Point (CP). None of the previously established stations in eastern Lake Calcasieu (Big Washout, Little Washout, Mid Lake) yielded enough seed or market oysters to support a Dermo assay. Oysters in the Big Washout, Little Washout, and Mid Lake areas have experienced excessive mortalities from oyster drills (Harbison, personal communication) which necessitated sampling from the lower salinity CP site. Seed oysters at CP had a PI of 40%, whereas market oysters showed a 60% PI. Last year the Sabine Lake sample showed 100% infection of market oysters with a WP of 1.13; this year's survey shows a 40% PI and a WP of 0.20.

Disease levels are low across the State. This is especially evident in areas east of the Mississippi River and around the Atchafalaya River. There is some uncertainty in the evaluation of the disease dynamics of oysters in the lower eastern portion of Lake Calcasieu, since oysters from there were unavailable this year. Disease levels from oysters in Sabine Lake, a cause for concern in last year's survey, have diminished. Records of disease levels from this year and previous years are available from Oyster Sentinel (www.oystersentinel.org).

Table 8-1. Percent Infection (PI) and Weighted Prevalence (WP) of seed and market-size oysters from Louisiana Public Seed Grounds: Summer 2012. Date is collection date, S = salinity, T = water temperature.

Station	Date	T (^{o}C)	S (ppt)	Seed PI	Seed WP	Market PI	Market WP
Three Mile Pass	7/15/12	30.2	14.8	0	0	20	0.07
Lonesome Island	7/12/12	28.7	15.1	--	--	0	0
North Black Bay	7/12/12	28.7	19.4	--	--	0	0
South Black Bay	7/12/12	29.4	19.0	--	--	0	0
Telegraph Point	7/12/12	30.2	21.6	--	--	20	0.10
Bay Crabe	7/12/12	28.6	14.2	--	--	0	0
Horseshoe Reef	7/11/12	28.5	21.6	--	--	0	0
Bay Gardene	7/12/12	28.6	11.1	--	--	0	0
Hackberry Bay	7/2/12	31.2	21.9	30	0.13	20	0.07
Lake Felicity	7/11/12	28.5	23.1	20	0.13	10	0.07
Lake Chien	7/11/12	28.3	22.6	33	0.41	30	0.27
Grand Pass	7/11/12	28.9	20.1	10	0.03	10	0.03
Old Camp	7/11/12	28.9	22.2	10	0.03	0	0
Bayou DeWest	7/12/12	28.7	20.3	0	0	10	0.03
Buckskin Bayou	7/12/12	29.0	18.4	0	0	10	0.10
South Point	7/16/12	29.1	7.7	0	0	--	--
Indian Point	7/16/12	29.3	15.7	0	0	0	0
Northeast Rabbit	7/11/12	26.2	19.9	56	0.59	60	0.97
Commissary Point	7/11/12	26.6	18.3	40	0.27	60	0.30
Sabine Lake	7/11/12	27.4	15.8	30	0.13	40	0.20

Literature Cited

Mackin, J.G. 1962. Oyster disease caused by *Dermocystidium marinum* and other microorganisms in Louisiana. Publ. Inst. Mar. Sci. Univ. Tex. 7:132-299

Mackin, J.G. and S.H. Hopkins. 1962. Studies on oyster mortality in relation to natural environments and to oil fields in Louisiana. Publ. Inst. Mar. Sci. Univ. Tex. 7:1-131.

Mackin, J.G., H.M. Owen and A. Collier. 1950. Preliminary note on the occurrence of a new protistan parasite, *Dermocystidium marinum* n.sp. in *Crassostrea virginica* (Gmelin) Science 111:328-329.

Ray S.M. 1966. A review of the culture method for detecting *Dermocystidium marinum* with suggested modifications and precautions. Proc. Natl. Shellfish. Assoc. 54:55-70.

Soniat, T.M. 1996. Epizootiology of *Perkinsus marinus* disease of eastern oysters in the Gulf of Mexico. J. Shellfish Res. 15:35-43.

Soniat, T.M. and E.V. Kortright. 1998. Estimating time to critical levels of *Perkinsus marinus* in eastern oysters, *Crassostrea virginica*. J. Shellfish Res. 17:1071-1080.

Soniat, T.M., J.H. Klinck, E.N. Powell, and E.E. Hofmann. 2005. Understanding the success and failure of oyster populations: climatic cycles and *Perkinsus marinus*. J. Shellfish Res. 24: 83-93.